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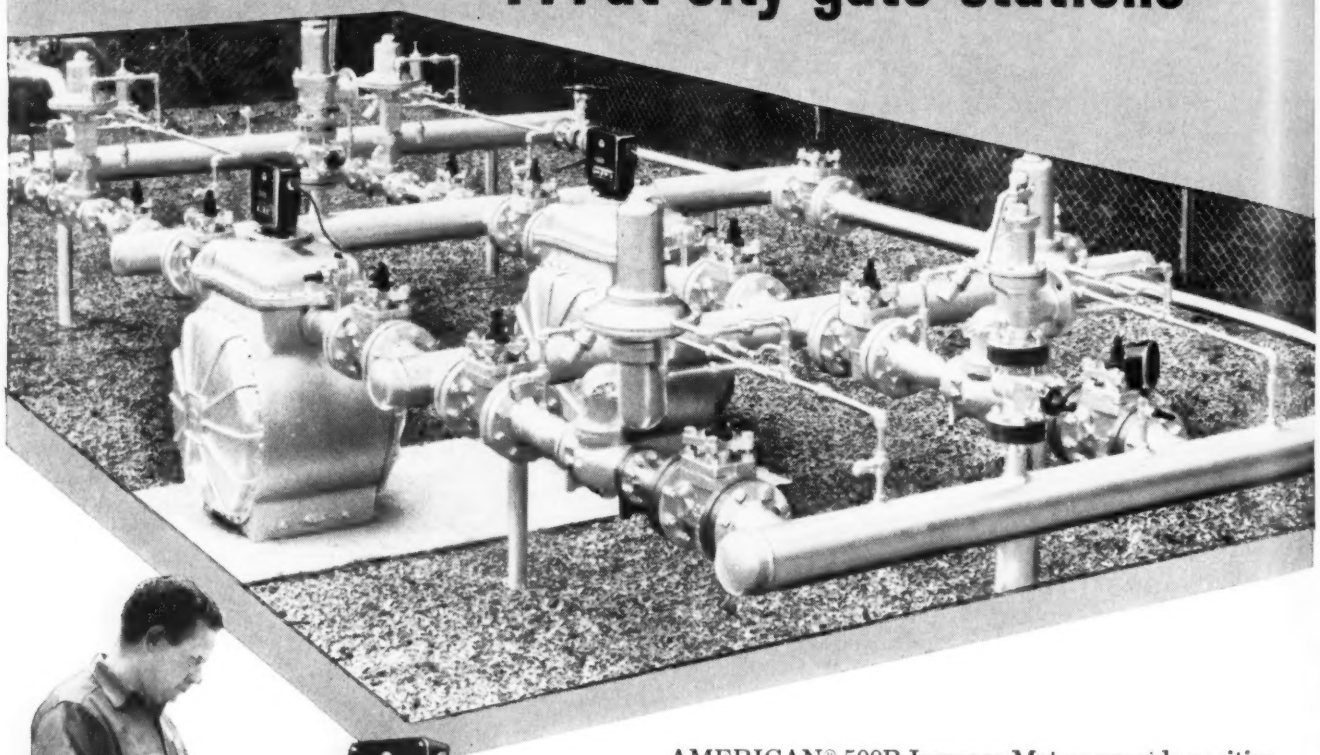
AUGUST 1961

The Crossing of Coldwater Creek

HOW TO ASSURE MEASUREMENT ACCURACY

...at city gate stations



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Editor's Notebook

Dear Reader:

What will a "New Frontier" FPC mean to the gas industry?

By the year's end, there may be an entirely new crop of faces on the commission. At least four will be Kennedy appointees. A fifth new face is also possible.

Three Kennedy appointees to date are: 1) Joseph C. Swidler, former general counsel to the Tennessee Valley Authority; 2) Howard Morgan, former Oregon utility commissioner, and 3) Lawrence O'Connor, who has been in charge of the Interior Department's oil import administration program. Swidler and Morgan have been confirmed by the Senate; O'Connor's confirmation is expected soon. A fourth man, to replace Commissioner Frederick Stueck, who died suddenly July 15, is yet to be made.

Fifth member is Chairman Jerome Kuykendall, whose term expires in June 1962. Kuykendall, under pressure, will relinquish the chairmanship on September 1, 1961 to Swidler. Whether he will remain on the commission until his term expires remains to be seen; Kuykendall hasn't said.

With the new lineup, the five-man FPC will have a peculiar make-up — two liberal, public power advocates (Swidler and Morgan), one more-or-less neutral (O'Connor), one moderate conservative (Kuykendall), and one undetermined, still to be appointed. By law, Kennedy cannot appoint more than three commissioners from the "majority" party (Democrats), but he can appoint self-proclaimed "independents" or liberals from other parties.

The new line-up, especially Swidler and Morgan, has caused considerable concern among natural gas men and investors. Recent reports state that the "New Frontier" team plans to act with dispatch in carrying out its program and do "many favors" for consumers. The program includes stern price control over producers, low regional price ceilings, elimination of pyramiding of rate increase applications, critical investigations of management and financial practices of gas companies, etc.

What this new group does may well determine the entire future of the natural gas industry. Abrupt policy shifts of a radical nature could ruin the industry. Changing the rules in the middle of the game could easily slow down or stop the game. Expansion would be stifled.

The really big losers would be the public — the consumers.

The new commission can either lift the FPC out of its morass of litigation and pending cases . . . or bury it deeper. Needed will be intelligent, economically sound action, designed to promote expansion of the gas industry . . . not unsound, uneconomic, unproved, new-dealish ideas.

— The Editor

American Gas Journal®

THE MAGAZINE OF GAS DISTRIBUTION

VOLUME 188 **AUGUST 1961** NUMBER 8

MANAGEMENT & OPERATIONS

The Crossing of Coldwater Creek 22

Graceful, unique pipe arch span — completely self-supporting — carries new Laclede Gas Company supply line across creek channel. How it was designed by company engineers, and how it was built is told in exclusive report.

PEAK SHAVING

Remote Controlled Propane-Air Plant Completely Automatic . . 28

Orange and Rockland Utilities' own gas engineering department designed new Middletown, New York plant that can be controlled from gas system operating center some 50 miles away.

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News about planned and proposed construction projects in the gas distribution industry.

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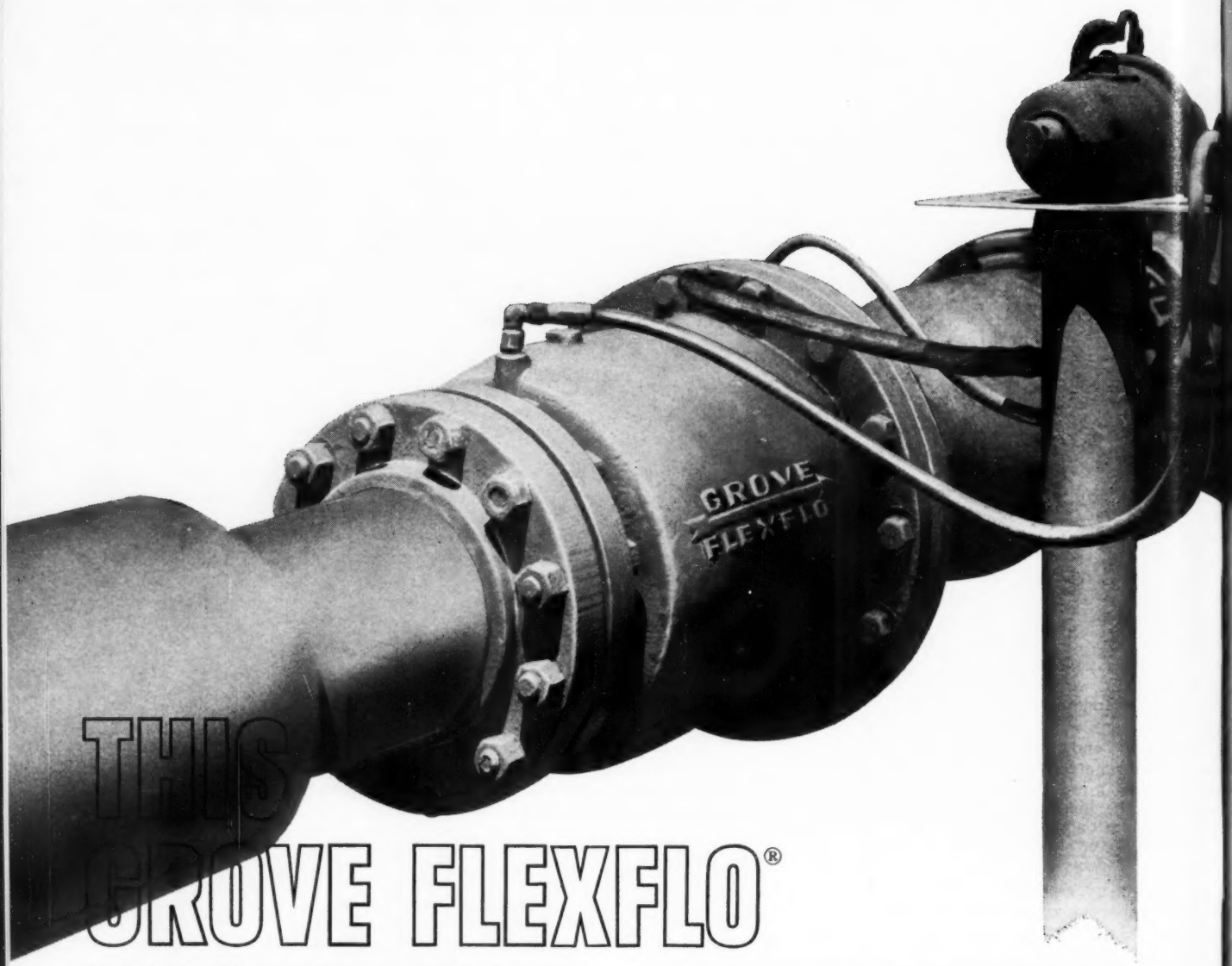

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NEWS HILITES OF THE INDUSTRY

Contract for gas turbine "total energy" package to be installed in Northern Illinois Gas Company's new office building at Glen Ellyn Illinois has been awarded to AiResearch Manufacturing Division of The Garrett Corporation, Phoenix, Arizona. AiResearch will furnish two natural-gas fueled turbines to drive high-frequency generators to provide all electric energy requirements of the building; waste heat boilers will utilize the turbines' exhaust heat to make steam for heating and absorption cooling. Another similar system for a new general office building will be contracted this autumn. *(See AGJ, July 1961 MCF, page 3.)*

Gas distribution contractors association — to serve as a clearing house for information of mutual interest among gas distribution piping contractors, concerning problems encountered, quality improvement, and improvement of safety standards — is in process of formation. E. H. Clark, vice president of Engineering-Construction Company, Tulsa, Oklahoma is chairman of the proposed group's organization committee.

Data processing systems: Six all-transistorized electronic data processing systems will be installed by *Public Service Electric and Gas Company of New Jersey* beginning in autumn, 1962. New EDP equipment includes one RCA 601 and five RCA 301 systems. They'll be used for billing, payroll accounting, stores and material accounting, depreciation studies, research, and engineering and operation functions . . . *Houston Natural Gas Company* has put its new UNIVAC Solid-State 80 Tape System with Off-Line Card Punching Printer to work on customer billing. Speed of new EDP unit is illustrated by time saved in processing inventory — from 3½ days to one-half day.

Laclede Gas Company of St. Louis and Kirkwood Propane Gas Service, Inc., have instituted a program of cooperative design and building propane gas distribution systems for new housing developments that may be a model for the rest of the gas industry. Under the plan, Kirkwood Propane will construct mains and service lines to Laclede's specifications and grant an exclusive option to Laclede to purchase the distribution facilities when natural gas becomes available in the area. Laclede, in turn, will assist the propane firm in financing construction of the multi-residence propane installations in parts of St. Louis county where Laclede is not now supplying gas. The cooperative program, which has no formal agreements or contracts, benefits not only the gas utility and the propane distributor, but also potential customers, providing them (and the new home builders) an incentive to install gas appliances.

How hot is hot? People, for instance, begin to "melt" when the temperature hits 90 . . . but for metals like tantalum, melting doesn't occur until the gage registers 5400 F. Such high temperatures are now possible using a new heating process that utilizes natural gas. The new method, which can produce a heat source in the 3000 to 6000 F range, opens up many new industrial uses for natural gas. The process, which utilizes a "boosted" burner, has been under development for two years by Arthur D. Little, Inc., as part of a research program conducted for A.G.A.

Volume of natural gas used in steelmaking may greatly increase in the near future. Steel companies in the Pittsburgh area are reported negotiating with gas utilities for large additional supplies. The gas would be used for both blast furnace and open hearth furnace operations using new technological developments.

Research — not a national fuels policy — should be the aim of the coal industry in expanding its market. Assistant secretary of the interior John M. Kelly told the 1961 coal show of the American Mining Congress that the coal industry and the federal government should pool research energies to find new and better uses for coal. He specifically pointed toward three goals: 1) Moving ahead on gasification of coal with the aim of producing a gas that can be mixed with natural gas for industrial and residential use; 2) Create from coal liquid fuel that could be utilized by oil refiners, and 3) Development of efficient, inexpensive new methods of transporting coal.

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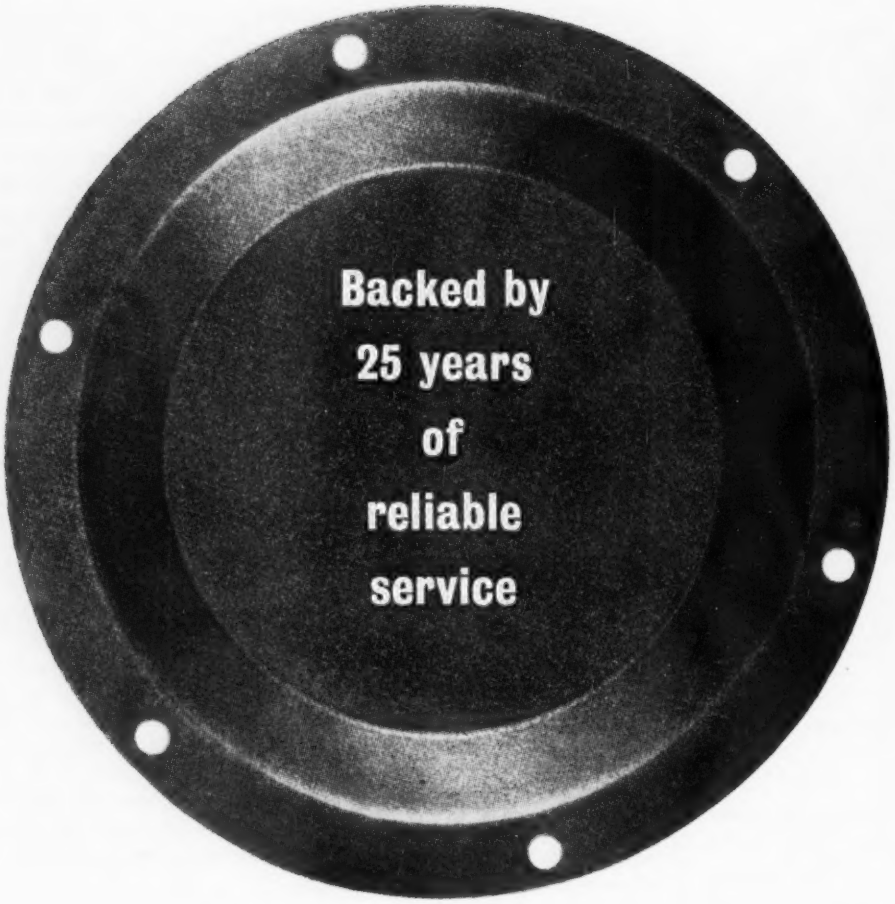

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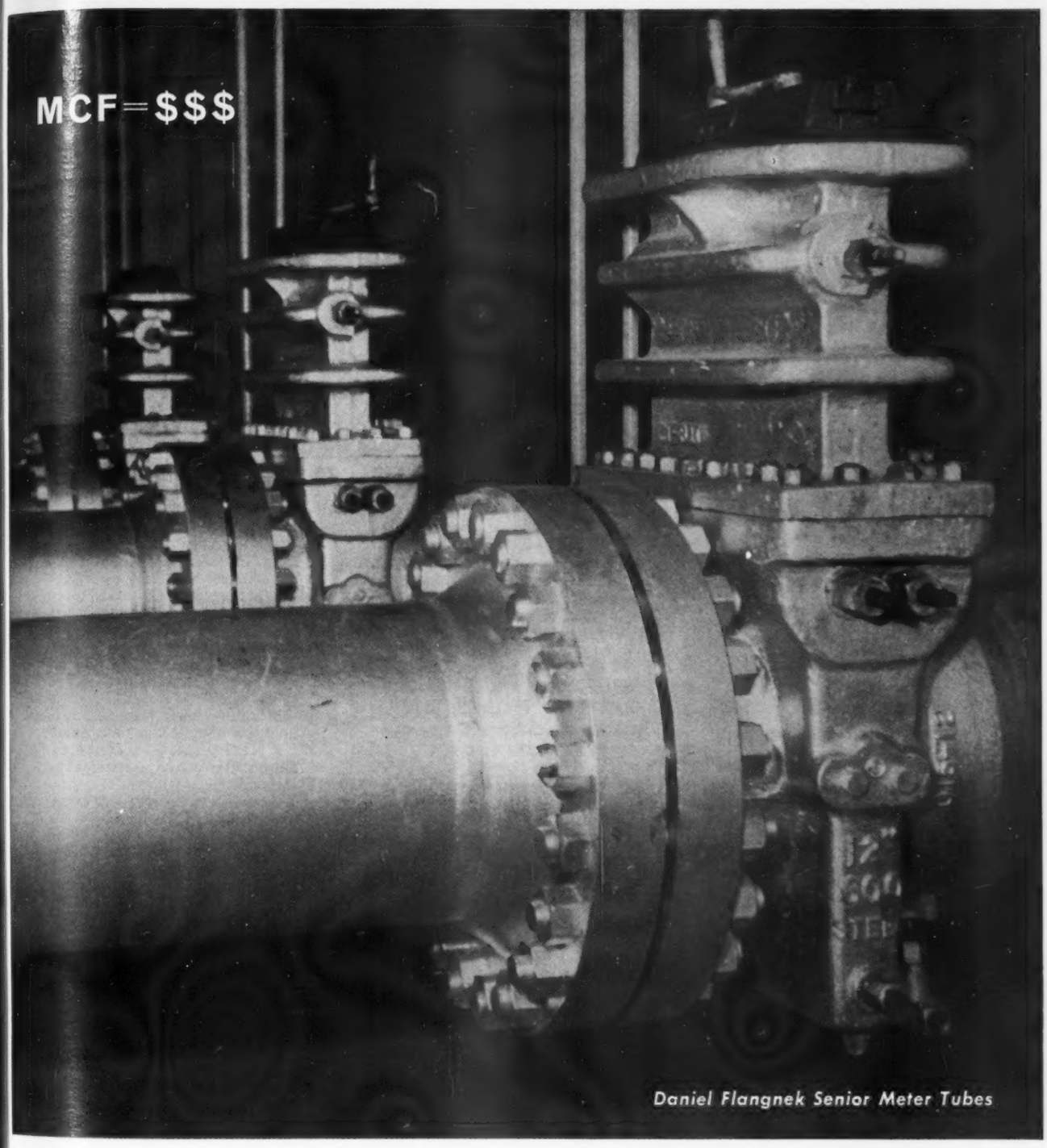

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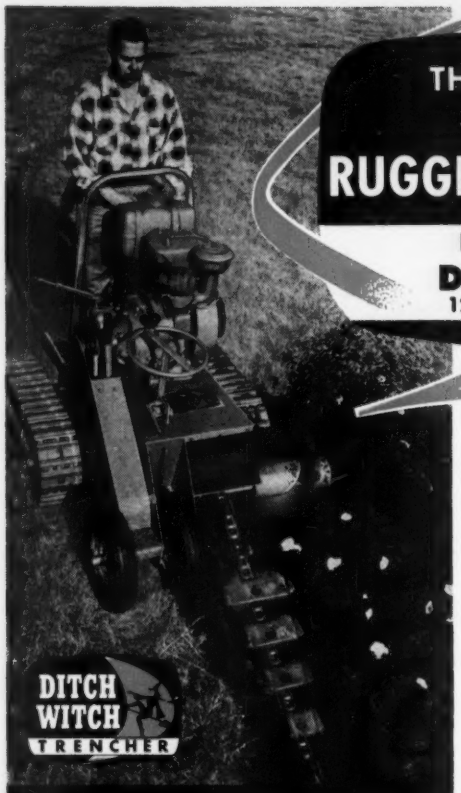

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Calendar

OF COMING EVENTS

August

28-30 Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, West Virginia.

September

7 Rocky Mountain Gas Association, annual banquet, Denver Hilton, Denver, Colorado.

11-13 A.G.A. annual accident prevention conference, Statler Hilton Hotel, Dallas, Texas.

11-15 ISA fall instrument-automation conference and exhibit, Biltmore Hotel, Los Angeles, California.

12-14 Mid-West Gas Association school and conference, Ames, Iowa.

13-15 PCGA annual convention, Coronado Hotel, Coronado, California.

15-16 Maryland-District of Columbia Utilities Association, fall conference, Cavalier Hotel, Virginia Beach, Virginia.

18-19 NEGA gas utility managers conference, Bald Peak Colony Club, Melvin Village, New Hampshire.

18-19 Independent Natural Gas Association of America, annual membership meeting, Adolphus Hotel, Dallas, Texas.

18-22 A.G.A. industrial gas school, Marriott Motor Hotel, Philadelphia, Pennsylvania.

20-22 Southeastern Gas Association, annual meeting, Roanoke, Virginia.

21 NEGA safety conference, Statler Hilton, Boston, Massachusetts.

24-27 ASME Petroleum Mechanical Engineering Conference, Hotel Muehlebach, Kansas City, Missouri.

25-28 American Welding Society fall meeting, Adolphus Hotel, Dallas, Texas.

27-29 Oklahoma Corrosion Course, sponsored by NACE and U. of Oklahoma, Norman, Oklahoma.

October

1- 4 A.G.A. annual convention, Dallas, Texas.

3-4 Ninth Annual Gas Measurement Institute, Southwest Kansas Center, National Guard Armory, Liberal, Kansas.

4- 6 NACE western regional conference, Benson Hotel, Portland, Oregon.

9-11 NACE north central regional conference, Chase Park Plaza Hotel, St. Louis, Missouri.

18-19 Wisconsin Utilities Association, gas and electric sales and operating convention, Schroeder Hotel, Milwaukee, Wisconsin.

24-25 AGA-NEGA safety course, Parker House, Boston, Massachusetts.

24-27 NACE south central regional conference and exhibit, Shamrock Hotel, Houston, Texas.

29-31 Independent Petroleum Association of America annual meeting, Shamrock Hilton Hotel, Houston, Texas.

November

13-15 American Petroleum Institute, annual meeting, Chicago, Illinois.

26-Dec. 1 American Society of Mechanical Engineers, New York, New York.

27-Dec. 1 NACE southeast regional conference, Key Biscayne Hotel, Miami, Florida.

Men At Work

J. S. Phillips

W. P. Dick

F. R. Palin

H. J. Denison

James S. Phillips, vice president and general manager of the United Fuel Gas Co. and affiliated companies of the Charleston Group of the Columbia Gas System, has been elected president of the respective companies of the Charleston Group companies. He succeeds **John W. Partridge,** who has been elected president of the Columbia Gas System, Inc., United Fuel's parent company. **W. P. Dick,** vice president of the Charleston Group companies has been named to succeed Phillips as vice president and general manager.

Southern Counties Gas Co. has announced the appointment of **John R. Feehan** as local manager for Garden Grove, Huntington Beach, and adjacent areas of Orange County. **Arthur R. Bermudez** succeeds Feehan as new business supervisor in the sales department of Southern Counties Gas Co.'s San Gabriel Valley Division.

Union Gas Co. of Canada, Ltd. has announced the appointment of **F. R. Palin,** general manager and formerly treasurer, as vice president of the company. He will continue as general manager. **H. J. Denison,** former comptroller and assistant treasurer, succeeds Palin as treasurer. **W. G. Stewart** succeeds Denison as comptroller. **D. E. Smith,** who has been associated with company's accounting department for a number of years, has been named assistant comptroller and an assistant treasurer.

Three executive appointments at Pacific Gas and Electric Co. include: Promotion of **O. R. Doerr,** vice-president in charge of sales, to vice president and assistant to the company's general manager, **S. L. Sibley. R. W. Joyce** has been elected to the new position of vice-president in charge of commercial operations. **W. D. Howell** has been appointed general sales manager.

Robert I. Nystrom has been appointed vice-president of the Citizens Gas Fuel Co. of Adrian, Michigan. He will continue as general superintendent also. Four other promotions also have been announced: **Thomas Haney,** formerly a distribution engineer, has been named distribution superintendent; **Pal Damon,** general foreman, has been promoted to shop superintendent; **Robert Marr** has moved up from maintenance foreman to maintenance and construction foreman. **Carl Phipps** has been named assistance engineer.

Jack L. Mowers has been appointed system supervisor of photography for Niagara Mohawk Power Corp., to coordinate photographic activities in the three divisions of the Niagara Mohawk system.

Hugh C. Wyland has been elected vice president of Commonwealth Services, Inc. He is director of Commonwealth's Industrial Relations Department, that is responsible for consulting work in management organization, planning, employee, and labor relations.

E. D. V. Dickey, manager of Citizens Gas Co. of Hannibal, Mo. since 1920, has retired from active service and will remain with the company as vice-president and board member. **Lester N. Dickson** succeeds Dickey as manager.

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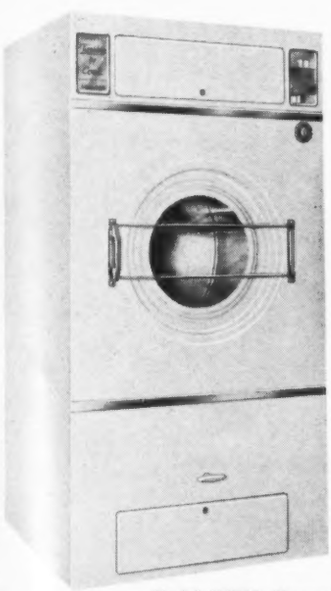

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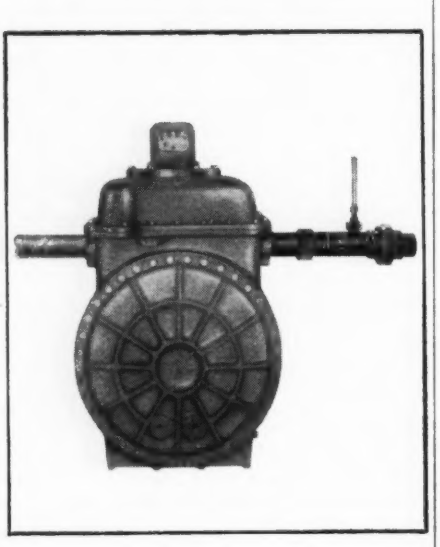

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Men at Work

B. L. (Bill) Dawson has been named manager of the Gas Appliance Center in Dallas, Texas.

B. L. Dawson

J. W. Fleer

John W. Fleer, former director of rates, has been named comptroller and treasurer of Minneapolis Gas Co. succeeding vice president **Hugh H. Hite,** who has retired. **Terrence P. O'Brien,** formerly Hite's assistant, has been elected assistant treasurer.

R. F. Ogborn has been promoted to manager of real estate and industrial engineering for Southern California Gas Co. In the newly-created post, Ogborn will assume responsibility for utility's land and building coordination and other real estate considerations.

Wilmer D. Relyea, assistant manager, industrial and commercial sales, Public Service Electric and Gas Co., has been nominated to serve a one-year term as chairman of the Industrial and Commercial Gas Section of the American Gas Association.

I. E. Rowe of Shreveport, gas utilization director for the Louisiana-Mississippi distribution division of United Gas Corporation since 1954, has been appointed utilization director for the entire distribution division of United Gas.

United Gas Improvement Company has announced personnel changes in their sales department. **Frank Krizan,** presently air conditioning sales engineer in the Philadelphia general office, becomes assistant to the sales manager of Lehigh Valley Gas Div. at Allentown, Pa. **Glenn W. Linderman,** now a commercial sales representative in the Reading Gas Div., transfers to the Philadelphia general office as an assistant to the manager of sales and public relations. **Robert M. Middleton,** residential sales supervisor in the Lancaster County Gas Div., transfers to the Harrisburg Gas Div. in the same capacity. **Robert W. Jones,** presently a commercial sales representative in the Reading Gas Div., becomes residential sales supervisor in the Lancaster County Gas Div. **John C. Sowa,** residential salesman in the Reading Gas Div., transfers to Lehigh Valley Gas Div. as residential sales supervisor.

Deaths

William Welch, Jr., 56, vice president of Long Island Lighting Co., died June 23 at his home in Westbury, New York, after a lengthy illness. Welch joined LILCO in 1941 and in 1958 was elected vice president in charge of engineering, purchasing, and stores.

Frank B. Wright, 69, former vice president of Southern Counties Gas Co. died June 17 in Cedar Falls, Iowa. At the time of his retirement in 1960 he served as vice president in charge of public relations, customers department, and division coordination. He started with the gas company in 1912 as a meter reader.

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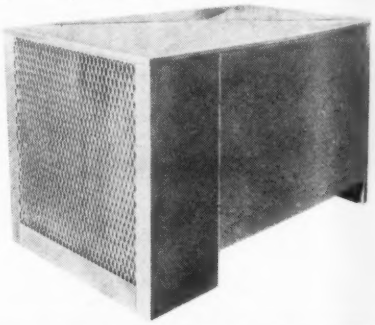

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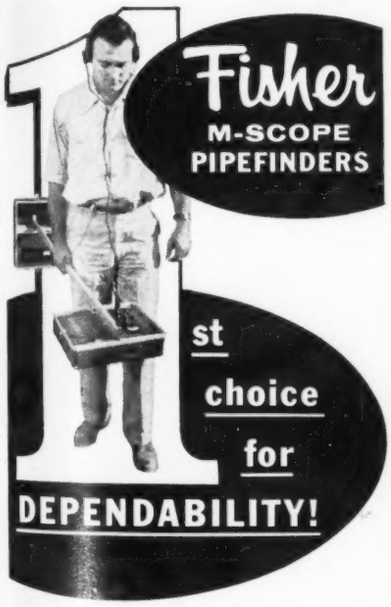

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Men at Work

Theron A. Brown, president and general manager, Madison Gas and Electric Co., has been elected chairman of the board of directors with **Edward R. Felber,** executive vice president, succeeding Brown as president and general manager.

J. W. Moorman, supervising claims representative for Southern California Gas Company, has been elected president of the California Conference of Arson Investigators for the current year. In his position with Southern California, Moorman is involved in investigation of all gas fires and explosions. He is a charter member of the arson conference.

Burton F. Wiand, vice president and director of Cities Service Gas Co., is being transferred to the parent Cities Service Co. in New York. His new assignment effective September 1, will entail coordination of industrial relations and public affairs activity for Cities Service organization.

Frederic O. Hess, president of Selas Corporation of America, has been appointed to the Committee on New Frontiers of Technology of the Chamber of Commerce of the United States. Mr. Hess, an authority on the gas industry, was nominated for the committee by Richard Wagner, president of the national chamber. The committee gives assistance to the chamber's board of directors on matters concerning utilization of the country's resources to best serve the nation's interest.

Thomas J. Watt has been appointed field sales manager of Sprague Meter Company, a Textron division. Watt has been with Sprague Meter over 32 years in various capacities of accounting, engineering, production and sales. Most recently he was eastern regional sales manager.

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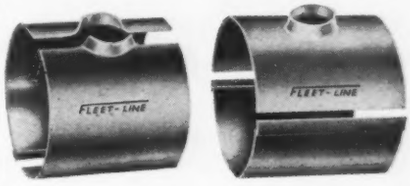

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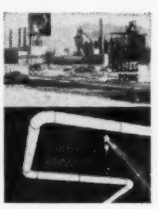
Spans creek in one day with pre-fabricated pipe arch

THIS self-supporting river crossing for a 20-inch gas pipeline was installed by Laclede Gas Co. in just one 12-hour working day. Midwest Piping pre-fabricated the entire 150-foot arch and its base headers in only two sections, each consisting of a converging pair of 16″ pipes.

The only installation of its type in the country, the arch is capable of carrying 200 million cubic feet of gas daily at 880 psi over the solid rock bed of Coldwater Creek north of St. Louis. For complete information on Midwest Piping's products and services, write for Bulletin 61A, PIPELINE FITTINGS.



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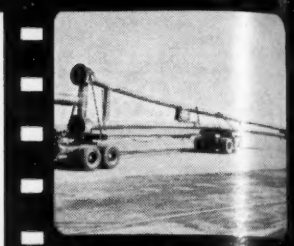

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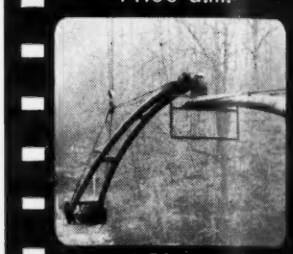

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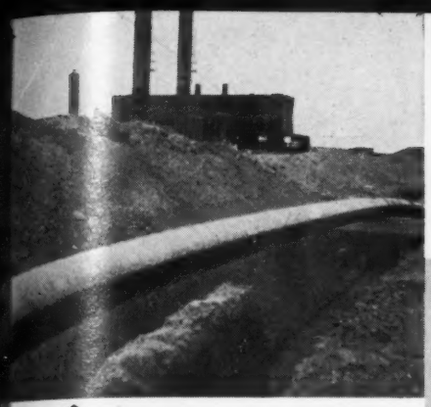

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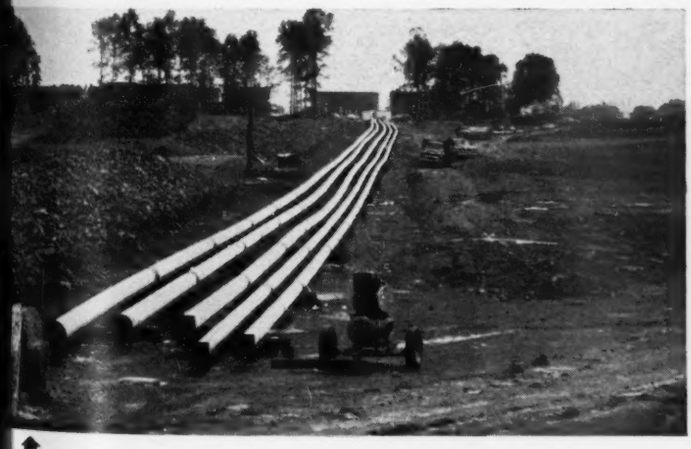

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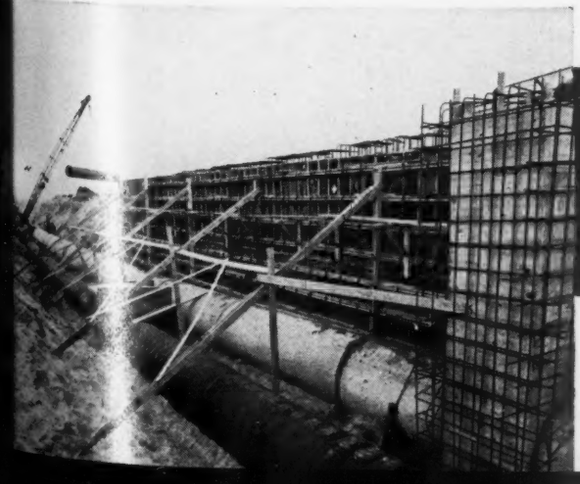

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The Crossing of Coldwater Creek

Final task in completing arch span came in dark ness. Laclede welders join two sections of th arch above Coldwater Creek's rushing waters

William H. Donnelly and E. V. McMullin
Engineering Department, Laclede Gas Company, St. Louis, Missouri

Only one of its kind in the country, unique self-supporting pipe arch designed by Laclede Gas Company engineers spans 150-ft creek, rises 20 ft vertically, is important link in new gas supply system for St. Louis County

Late in December 1960 Laclede Gas Company's engineering department was given what looked like a routine construction problem — design of an 11-mile high pressure supply line that was to be the connection for a new major supply of gas into the St. Louis area. Approximately 55,000 ft of this design was fairly routine. A 150 ft portion in the center of the entire project turned out to be quite a problem.

The new line was to operate at 880 psig with a capacity up to 200,000,000 cu ft per day; it had to be in service and operating by May 1, 1961. The 11-mile line was to connect with a new line from the east to be laid by Mississippi River Transmission Company from a connection with Trunkline Gas Company at Johnsonville, Illinois, to a point on the west bank of the Mississippi River, approximately 2 miles north of the city limits of St. Louis.

Initially, it was decided to use 20-in. API 5LX52 pipe of .312-in. and .344-in. wall thickness from a new "take point" station to be built on the bank of the Mississippi River. The new line would connect with Laclede's Lange Underground Storage Field located at Florissant, Missouri.

Crossing Coldwater Creek

A portion of the line in the preliminary design was laid out along U. S. Highway 67, the main connecting link between St. Louis, Missouri, and Alton, Illinois. Just south of U. S. Highway 140 there is a large drainage canal, emptying directly into the Missouri River, known as Coldwater Creek. In the preliminary survey for the line, it was found that Coldwater Creek at this point was a channel that nature had carved out of solid limestone rock.

Most obvious solution to the crossing of Coldwater Creek was to obtain State Highway Department permission to erect the line on an existing highway bridge. This proved to be impractical because the highway at this point is due for an ultimate relocation; the line would undoubtedly wind up in the middle of the relocation and would, therefore, have to be moved at some future date.

A second approach, also fairly obvious, was to install piers across the creek on one side of the highway bridge. After discussion with the Metropolitan Sewer District engineers, who have jurisdiction over drainage channels in the St. Louis area, this, too, was considered impractical because the channel of the drainage canal was also scheduled for a future widening.

Arch-Span Design Considered

Some two years previously, Laclede engineers had worked out some preliminary plans on an arch-type crossing of a smaller creek for a propane line; the project had been abandoned due to re-routing of the line.

At this time, the engineering department decided to resurrect the arch-type design and evaluate its possibilities to cross Coldwater Creek. Preliminary calculations indicated that if an arch-type construction were used, a 20-in. pipeline span with no supporting members could be erected that would clear the entire proposed new right-of-way of the drainage canal. Although calculations indicated the project was feasible, some doubts arose in the minds of Laclede engineers as to whether the assumptions used in the design were valid in theory.

A recognized expert in this field, Dr. R. E. Brielmeyer of Washington University, St. Louis, was called in to review and discuss the entire stress design and its assumptions. He reaffirmed the practicality of the design.

Preliminary calculations for a single span of 20-in. pipe called for use of an arch-type structure having a vertical rise of 20 ft with fixed ends, to be constructed of API 5LX52 pipe with a .500-in. wall thickness. Immediate availability of this type of pipe was doubtful. Plans were re-examined to determine possibility of using a double structure that would allow a reduction in both diameter and wall thickness that also would have the added advantage of increased lateral stability. The design was resolved to a double arch consisting of twin lines of 16-in. O.D. API 5LX42 pipe with a wall thickness of .375-in.

Next, an economic comparison was made of fabrication of such a steel arch in a shop and erecting it versus other alternatives — such as blasting a path under the canal or erecting a structure over the canal piece-by-piece. Economic studies indicate single piece construction might be more economical, particularly if construction of the span could be accomplished in a short period of time.

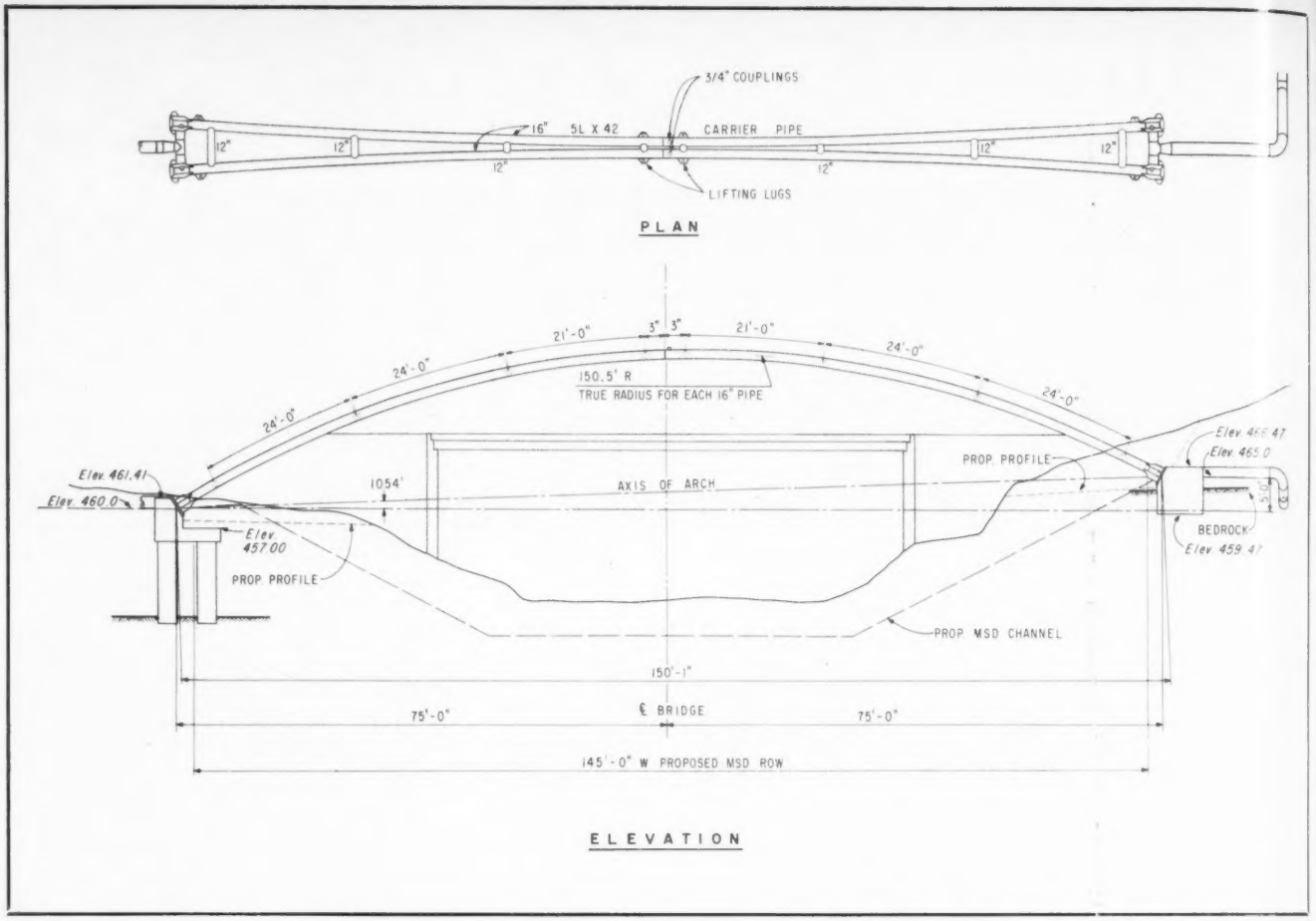
Big Equipment Needed

Engineers ran into a snag when they investigated availability of erection equipment that had enough capacity and boom length to pick up a one-piece span 150 ft long and weighing 13 tons and, working from the highway, erect it on an adjacent right-of-way whose centerline was 55 ft off the center of the highway. There simply was no such equipment available.

Two 60-ton cranes with 85-ft booms were available, however, and calculations showed each crane could handle one-half of the arch section. Consequently, design plans were revised again and new economic studies made of the con-

EDITOR'S NOTE: To its long list of accomplishments, Laclede Gas Company recently added another of significance to the gas industry — a company-engineered self-supporting arch pipe span that carries a new gas supply line across Coldwater Creek in north St. Louis County.

Told that it probably "couldn't be done," Laclede's engineers went right ahead and did it. The story of the graceful, unique arch span — how it was designed and built — is told in the following report prepared exclusively for American Gas Journal readers by Laclede's engineers responsible for this important gas industry achievement.



Plan and elevation views of span. Elevation view shows present and proposed sewer district channel profiles, which span design had to clear.

struction of the span in two halves with only a center weld to be made in the field. This proved to be the cheapest method of all the alternatives.

Stress Analysis

Laclede engineers went to work on this configuration from a stress analysis standpoint using the assumptions previously discussed and came up with a design for an arch member that measured 150 ft, 4-in. base-to-base on the foundation and with a 20 ft vertical rise that proved to be a segment of a circle. It was determined that under the B31.1.8 Code for a Class C location, under hydrostatic test conditions of approximately 1500 psi and a lateral wind loading of 100 mph, such an arch would have a design factor of safety of better than 4 to 1.

On this basis, the stress calculations were completed and drawings made up for an arch to be constructed in two sections. Each of the sections, in order to span 150-ft base to base with this much vertical rise, turned out to be 80-ft in length.

Fabricator's Know-How Important

The problem quickly resolved from one of stress calculation and material design to finding a fabricator who had the space, equipment, and know-how necessary to handle such a large piece of fabrication. Drawings were prepared and sent to several fabricators for bids. A local St. Louis company, Midwest Piping Company, Division of Crane Company, evidenced great interest in handling such a job.

After consultation between engineers of Laclede Gas and Midwest Piping Company the firm was awarded the contract for fabrication of the arch. Because Midwest was a local company and time was running short, it was felt that it would be distinctly advantageous to have the fabrication done locally so that Laclede engineers could be in on the actual production scheduling, fabrication, shipping and erection.

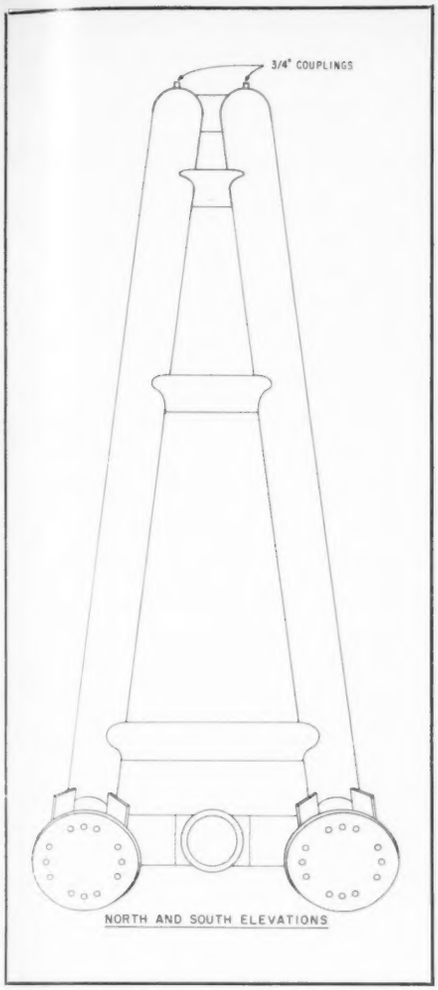
Pipe Selection

Next immediate problem was procurement of the type of pipe that we felt was necessary for this design. For reasons previously discussed, and because of the external structural welding and lifting lugs for handling, the design was based on the use of 16-in. O.D., .375-in. wall pipe with a minimum yield of at least 42,000 psi. Because of our previous experience with welding under field conditions of high tensile cold-worked pipe, we felt that it would be better to procure a pipe that had the desired minimum yield due to its chemical constituents rather than cold expansion. The basis in the theory of design in going from the .344-in. wall, which was being used in the 5LX52 line pipe, to the .375-in. wall was to drop the working hoop stress below 50 percent of the specified minimum yield so that external welding of attachments would be permitted under the ASA B31.1 Piping Code.

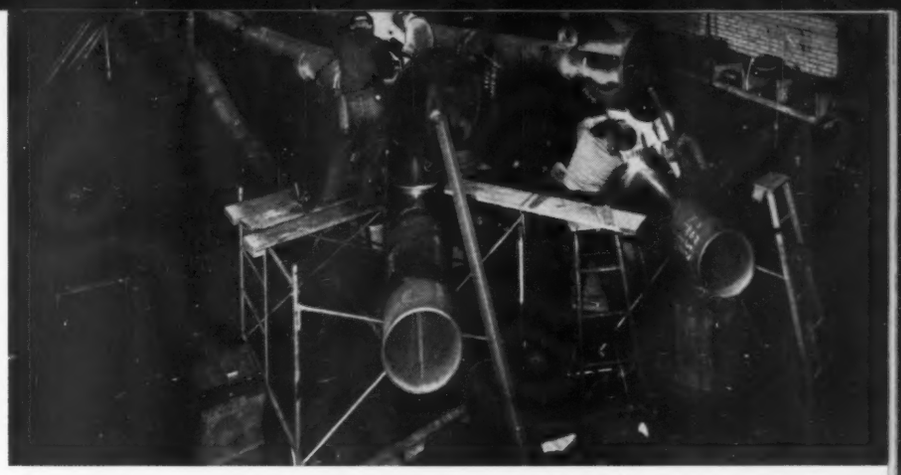
The National Tube Company of Lorain, Ohio, was extremely cooperative in making a special shipment of this pipe so that we might have it in time to get the fabrication and erection by May 1. Midwest, upon receipt of the pipe from National Tube Co., even before the final design was completed, proceeded to hot-bend 40-ft lengths of 16-in. pipe into segments of a circle having a 150-ft radius.

Fabrication and Testing

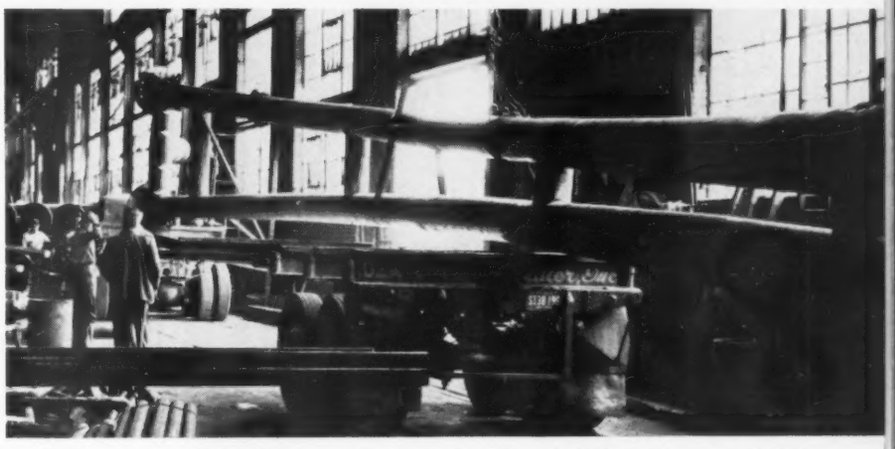
When Midwest had finished its shop drawings it became necessary for them to locate shop space for the fabrication



End view of fabricated span.



Arch span takes form in St. Louis fabricating shop of Midwest Piping as welders join specially-shaped pipe sections to form section of a 150-ft radius circle.



For shipment to erection site, completed assembly of one-half the arch span is loaded onto pipe trailer.

of the two 80-ft segments. The two pieces were fabricated by laying a single circular segment on its side on the shop floor and welding in a vertical position the 12-in. external struts that were to become the final cross bracing. The second circular segment was laid out and set on top of the 12-in. vertical supports for the final welding. End connections to the pipeline and the base supporting flanges (shown in accompanying photographs) were also given considerable thought in the design layout.

An added problem in the fabrication and time requirements was the 100% radiography inspection specified by Laclede. Because the pieces were of such length and size that they were not easily handled for movement into the radiographic areas, it was necessary to perform the radiography in the fabrication area.

For purposes of resisting wind loading, the design encompassed the idea of leaning the two circular segments together at the center of the arch from a spread footing at the base. This made it necessary to design the base flanges at an angle to the center line of the incoming pipeline connection in three planes.

While this increased the difficulty in the lay-out of the concrete foundation, the foundation design itself was made sufficiently flexible to compensate for this. This was accomplished by using drilling templates to which the base flanges had been drilled in order to grout one set of foundation bolts on each flange into place ahead of time, and to equip the matching base with bolt sleeves into which double end studs could be screwed after the arch was in position and the first base flange lined up.

This required extremely careful foundation layout and forming to achieve the accuracy necessary for alignment of the foundation faces. This portion of the job was ably handled by Frazier-Davis Construction Co.

In order to have fixed ends it was necessary — on the south side — to drill out the limestone rock for the footing. On the north side it was necessary to set three 36-in. reinforced piers tied into the red rock with steel dowels.

Tangential Loading Required

One of the features of the design that Laclede engineers felt was extremely important was the fact that, when the pieces were unloaded on the site, they must be picked up by the cranes and loaded tangentially so that the loading during the handling and erection of the pieces would be exactly the same as the loading on the arch after it was in place and loaded under its own weight.

This required a good deal of consultation with the erection sub-contractor, the Ben Hur Construction Company, so that a method of rigging could be worked out ahead of time to assure this tangetial loading.

This was done and the rigging cables and fittings were laid out prior to the day of actual erection. The erector preferred originally to pick up the pieces tangentially loaded in the manner described above.

The problem was to ship the pieces in a position that would allow this type of handling since the only vehicles available for handling the extreme lengths were pole-type trailers. It was decided to weld them with structural external attachments vertically between the truck bolster and trailer and to haul them in this position.

There were several reasons for adopting the tangentially-

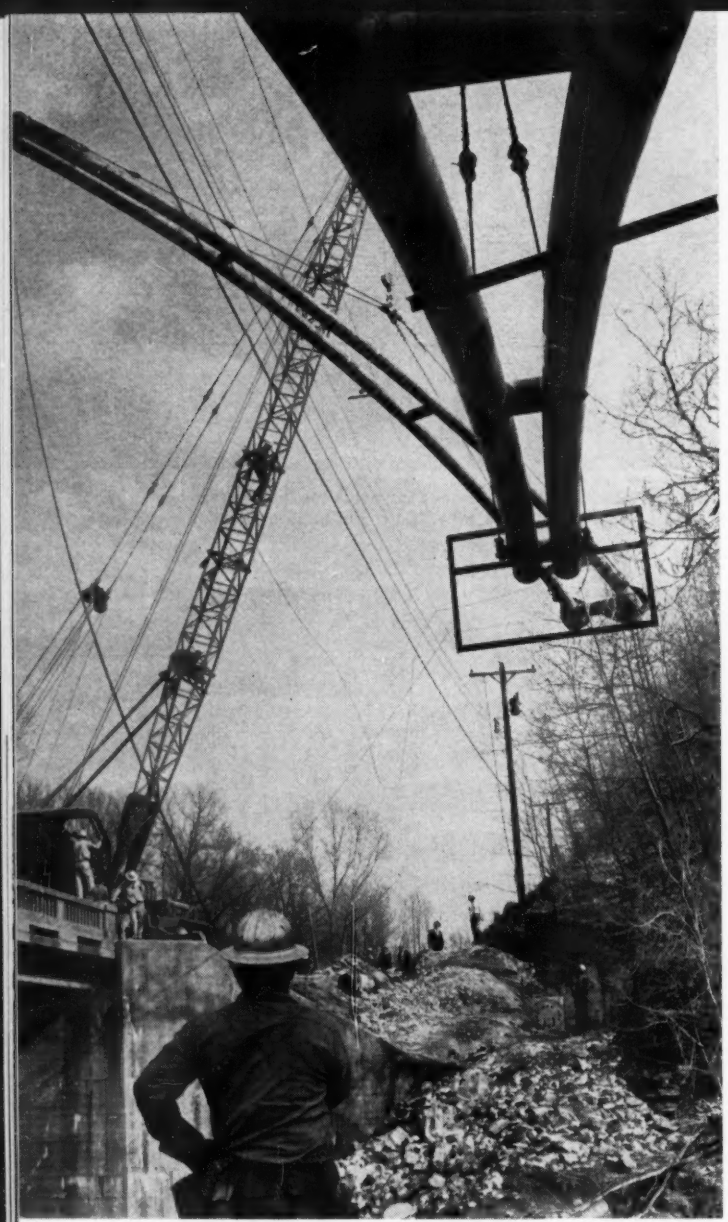
loaded type of rigging. Primarily, we could not afford any movement caused by deflection due to handling the pieces from the center as we were working between a fixed set of foundations already in place. Once the foundation ends were fixed, any deflection would have to be taken up in misalignment in the center connection and this could not be tolerated.

One-Day Erection

We decided to try erection in one day. The pieces were loaded out of Midwest's shop, hauled to the job site, and left standing overnight, one on either side of the drainage canal. At 8 a.m. the following day, the erection contractor arrived with the previously-fabricated rigging and cranes. Arrangements had been made with the State Highway Patrol to block off one-half of the highway as the cranes, when turned 90 degrees to the roadway, partially blocked the travelled portion of the highway. Another obstruction that had to be cleared was a 13,000-volt electric transmission line. Electric service was interrupted prior to the actual erection but the lines remained in place throughout the construction and, therefore, had to be cleared.

The trailer loading required the contractor to pick the span selections off the trailers on their sides and rotate them in mid-air to the tangential loading position. North section of the arch was unloaded from the truck first and turned in mid-air as previously planned. As soon as the turn was complete it was evident the structure had sufficient rigidity to be handled and maneuvered. It was immediately lifted over the electric transmission line, lowered and the base flanges set and bolted to the foundations. While this was being done, the rigging crew proceeded to the south section, fitted the rigging, and picked it up with the 45-ton crane and swung it into position.

Time required for the actual rigging and fitting for the



Six and-one-half tons of steel, poised in mid-air, are readied for positioning as second half of pipe span. First section yawns out over workman's head, ready to meet it.

Laclede engineer Ed McMullin, left, confers with construction contractor as work progresses.

Late in the spring afternoon, the two ends are eased together.

base flanges, bolting and shimming, was approximately eight hours from the time the cranes arrived on the site. A platform was attached, the welders proceeded to fasten the line-up clamps in place to begin the welding procedure.

One Final Problem

At this point we discovered — while the pipe was aligned horizontally perfect — that, vertically, the top segments of the two sections were butted tight while the bottoms gapped approximately 3/16-in.

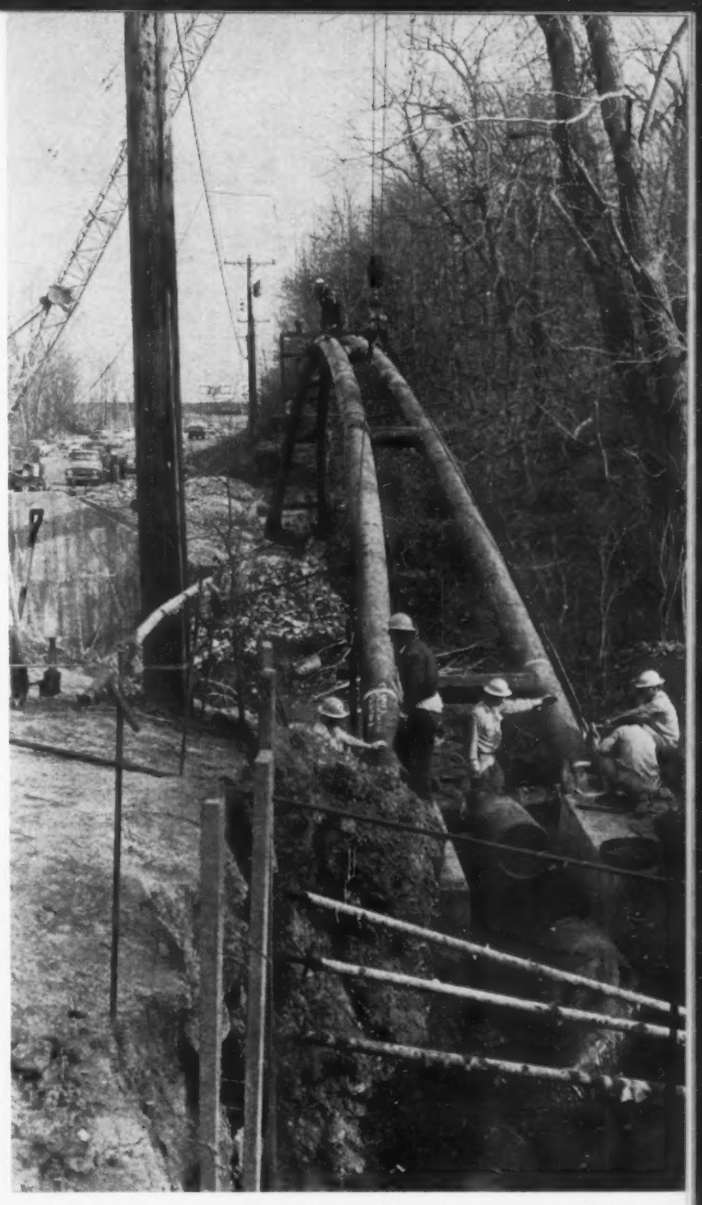
This proved to be the unfortunate part of our trick of loading the pipe sections tangentially. Anything we then did with either of the two cranes would only raise or lower the segments relatively. What we needed to do was apply a vertical force directly so that the gap could be taken up by the addition of shims on the foundation.

We decided to bolt both segments tight on the foundations and to pull the line-up clamps tight. Then the crane on the north side was instructed to drop its load and swing to a previously attached cable in the center of the span. (There was some discussion about the possibility of tieing the whip line to the center cable and using it for a hoist, but the cranes were so far off to the side the whip line would have run out of the sheave so this idea was abandoned.)

As soon as the crane picked up the load in the center, the line-up clamps were refitted, the alignment was made perfectly, and two welders working simultaneously on the same weld proceeded to make the final tie-in. When the weld was complete, it was allowed 15 minutes to cool. Both cranes were detached, and the crossing was completed.

On the following day, the pipeline was welded to each base end and a hydrostatic test placed on the structure. On April 29, 1961, the line was pressurized and placed in operation.

* * *



Both sections in place, arch span takes shape as crews bolt and shim base, check foundations, and prepare to position platform at center for welders.

Official spectators during span erection included, left to right, Laclede's vice president i/c operations Allen Burgess, assistant vice president i/c operations Lee Liberman, and Bill Donnelly, engineer in charge of project.

Completed span, graceful in appearance, is ready for service. Painters applied finishing touches shortly after photo was made.

Remote Controlled Propane-Air Plant Features Fully Automatic Starting

Hamilton Gaillard, Chief Gas Engineer
Orange and Rockland Utilities, Inc., Spring Valley, New York

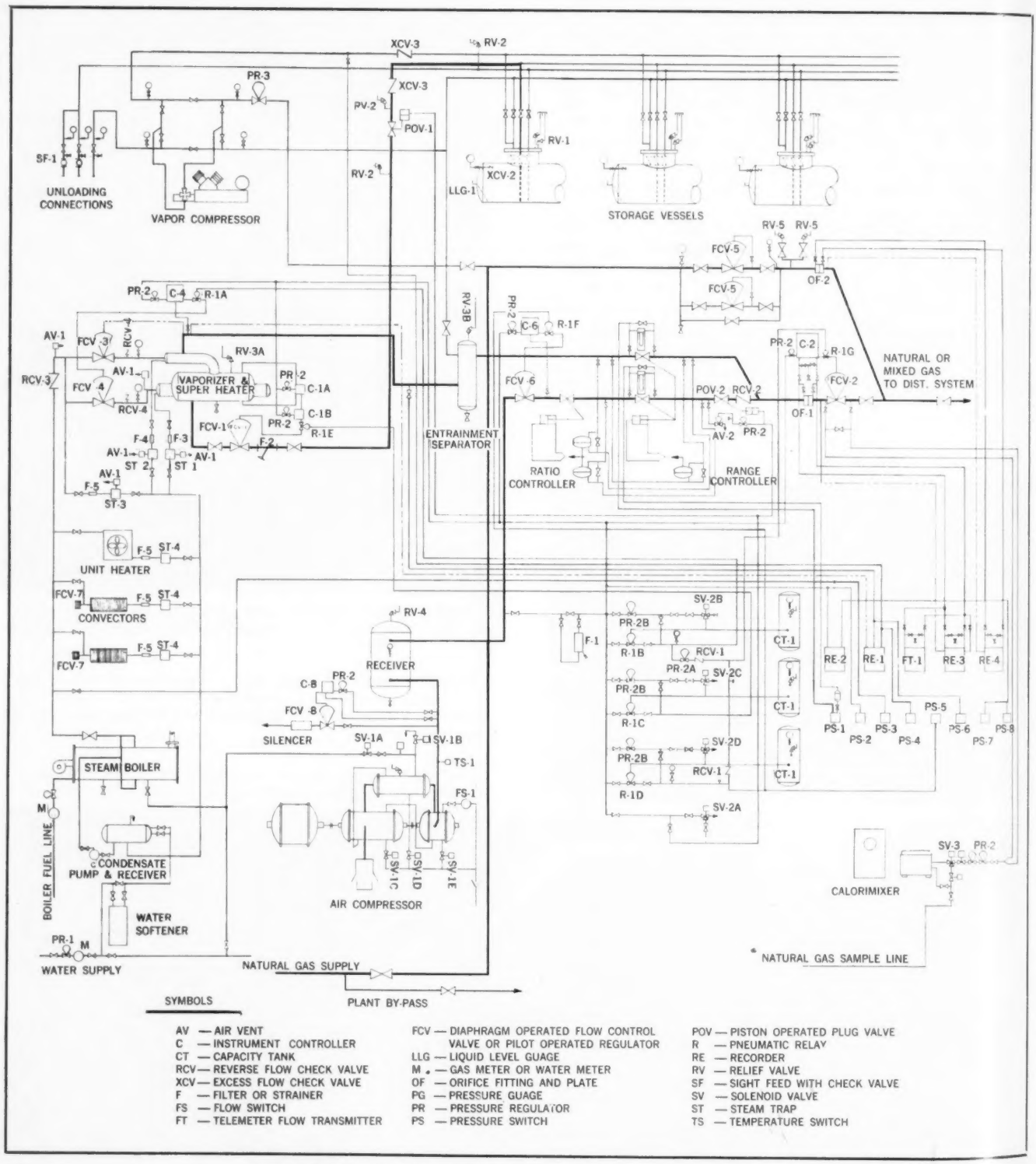


FIG. 1. **Schematic piping diagram** of the Middletown propane-air plant.

Building at left houses boiler, air compressor, and controls. Building in center is vaporizer building. Storage tanks appear in right background.

Orange and Rockland Utilities, Inc. has recently completed a propane-air peak-shaving plant that features fully automatic starting from a completely inactive state upon the transmission of a single remote control signal.

The new plant, located at Middletown, New York, is controlled from the gas system operating center in Spring Valley, New York, some 50 miles away. The plant's capacity is 7500 Mcf per day with a maximum delivery pressure of 100 psig. Gas is produced at a constant heating value of 1450 Btu.

The plant was designated by the company's own gas engineering department, and a company crew installed most of the equipment and piping. Basic design of the new plant is similar to that of the company's two other propane-air installations, the oldest of which was constructed in 1942 and one of the first to be built.

Certain features of the older plants, particularly with regard to mixing controls and method of vaporization had proved satisfactory over the course of time and were retained in the new plant.

A brief explanation of the primary components and basic process is necessary to the understanding of the control system.

Storage, Unloading and Pressurizing

Propane is stored aboveground in six ACF 30,000-gal, 132-in. diam tanks with welded steel saddles. Provision has been made for additional storage capacity as needed. Each tank is connected to a four-line manifold through manually operated block valves. One liquid and one vapor connection are used for transfer of propane, the other liquid and vapor connection being used in plant operation.

Normally, the operating line valves are left open on two tanks. This provides enough storage for at least 24 hours of normal operation. During operating periods, a plant inspection is made once a day and tanks are switched at that time if necessary. The liquid line between the storage tanks and the plant is normally closed by a spring-return air operated plug valve located near the tanks, and is opened by air pressure at the beginning of the start-up sequence.

A Brunner 7½-hp motor-driven vapor compressor with a reversing valve is connected to the tank manifolds, to the unloading connections, and to a source of natural gas through a nest of valves that provides considerable flexibility of connection. This unit is used for the transfer of propane and for pressurizing the operating storage tanks with natural gas. The latter function is part of the automatic operation, so that when a starting sequence has been initiated, this uint will operate to hold a preset storage pressure.

Steam Supply

Steam for vaporization of propane and for space heating is provided by a York-Shipley 100-hp, gas fired, horizontal package-type low pressure boiler with modulating controls. The boiler has its own programming and safety controls that meet both Hartford and F.I.A. requirements.

The control system requires only a maintained closed contact from an external control to produce steam at regulated pressure. The boiler is put into operation by either the process sequence control or a room thermostat. Heating units have independent thermostatic control to prevent overheating the buildings when the boiler is delivering process steam. Heating system and process condensate is returned to a receiver and pumped into the boiler, as its level control demands.

In cold weather, when the plant is most likely to be required, use of the boiler for space heating keeps it hot and provides faster starts. If at any time during an idle period, the boiler should fail to operate on thermostat, the gas system operator would receive an alarm over the remote control system as soon as the room temperature had dropped a few degrees below normal.

Air Supply

Air at 115 psi is supplied by a Fuller two-stage, rotary, water-cooled compressor with a G.E. 350-hp induction motor drive. The compressor is equipped with an intercooler but no aftercooler, and has an electro-pneumatic loading system. The motor is controlled through a G.E. motor controller that contains not only the starting contacts and overload protection but also a disconnect mechanism and fault current protection in one cabinet. No other service entrance equipment is required.

The compressor, when in operation, is automatically monitored for lubrication, cooling water pressure and flow, discharge temperature and pressure. It is equipped with solenoid operated valves for the control of cooling water and the draining of the jackets during standby. Condensate drainage is automatic. The electro-pneumatic loading system prevents the compressor from being loaded for about three seconds after the drive motor is energized.

Vaporization of Liquid Propane

Propane is vaporized at a pressure of 110 psig and a superheat temperature of 90 F in a Drake and Townsend horizontal shell and tube exchanger with an attached superheater section.

When the vaporizer is in operation, the liquid feed is controlled by a Fisher diaphragm operated valve and pneumatic level control to provide a fixed liquid level just above the uppermost steam tube. Steam feed to the vaporizer section is controlled by a diaphragm operated valve and a Fisher pressure control pilot taking its control signal from the propane pressure at the dis-

charge of the superheater. Steam feed to the superheater section is controlled by a direct action thermostatic valve.

Proportioning Controls

Propane and air are proportioned by a Cutler-Hammer wide-range ratio controller supervised by a calorimixer of modified design. Among the special features are contacts in the recorder which are closed only when the heating value is within acceptable limits. The plant will operate only at minimum flow rate if these contacts are open.

An auxiliary differential pressure switch operating independently of the proportioning controls provides cut-off of the air supply and positions the flow control valve in the start-up position, should the heating valve fall below about 1200 Btu, regardless of flow rate.

Flow Control

Production rate of the plant is controlled by a Foxboro pneumatic differential pressure flow controller with remote electric index set. Timing relays in the field supervisory control, selected by remote control, provide discrete adjustments of the controller index.

Natural gas delivered to the distribution system passes through the plant where it is regulated to a constant pressure by two parallel Rockwell pilot-loaded regulators. Propane-air, when produced, is mixed with natural gas downstream of these regulators causing them to close sufficiently to maintain distribution pressure. Conversely, when the plant shuts down, intentionally or because of a malfunction, the natural gas regulators immediately open to maintain pressure.

Supervisory and Telemetric Equipment

Control and indication functions are transmitted by Femco supervisory equipment operating over a telegraph grade, single-pair, leased line. This line also transmits, without the use of tones, the telemetric flow rate signal from a Foxboro Teletax transmitter to a receiver recorder in the office.

The d-c telemetric signal is normally on the line and is interrupted briefly whenever a control or indication function is being transmitted. Special circuitry prevents an erratic flow record during a supervisory transmission.

The office and field units of the supervisory equipment have similar control switches and indication lights. The plant may be switched from remote to local control at any time whether or not in operation. In addition to the plant start and stop function, the boiler, the vapor compressor, and the air compressor may be operated independently at the system operator's discretion.

All control functions are verified in the field unit and indicated by lamps on both office and field panels. The indication functions automatically transmitted by the field unit are:

Completion of start-up sequence
Heating value within acceptable limits
High distribution pressure
Low distribution pressure
High vaporizer pressure
Low room temperature
Fire in either building

The process sequence control, designed by the gas engineering department of Orange and Rockland Utilities, Inc., was built by Femco, Inc., and incorporated in the field supervisory cabinet.

Natural gas and propane-air flows, along with various plant pressures and temperatures are recorded on seven-day disc charts throughout the year.

Structures

All plant equipment is housed in two 24-ft by 36-ft cinder block buildings. The "vaporizer" building houses the vaporizer-superheater and its controls, the unloading compressor, the ratio controller, the flow controller, and the natural gas regulators. The vaporizer room contains a minimum of electrical equipment because of the necessity of explosion proof construction.

The "compressor" building houses the air compressor, the boiler and condensate system, recording equipment, and the supervisory and sequencing controls.

Pneumatic sensing and control lines between buildings consist of a bundle

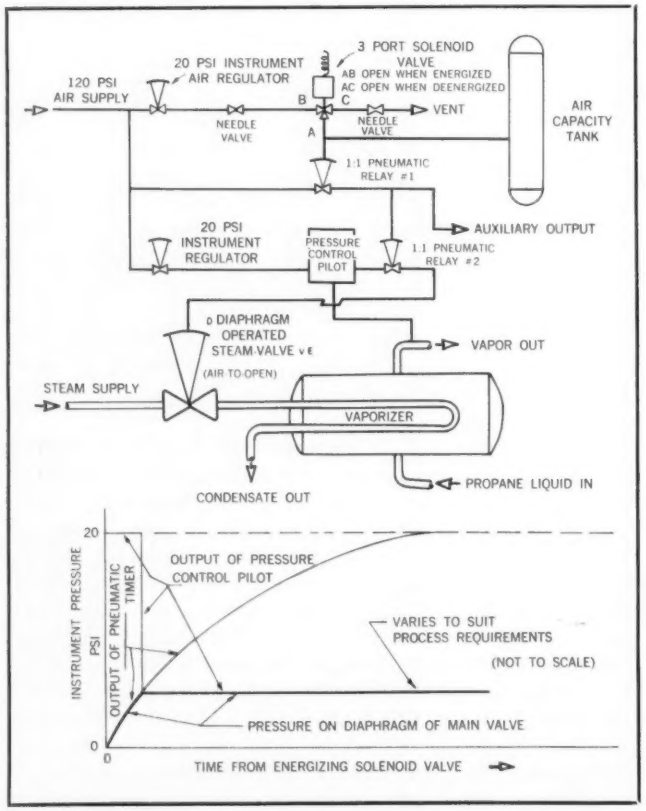


FIG. 2. **Typical method of initiating operation** of instrument control valves.

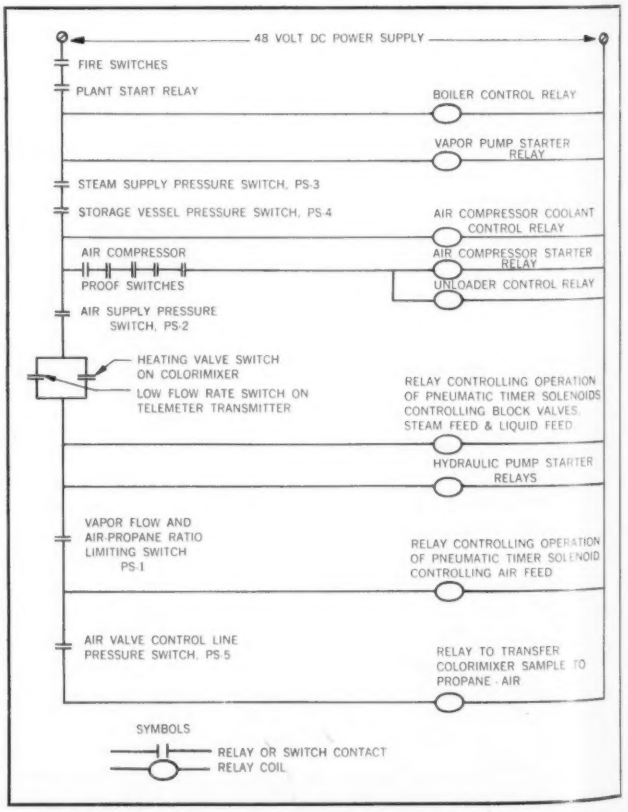
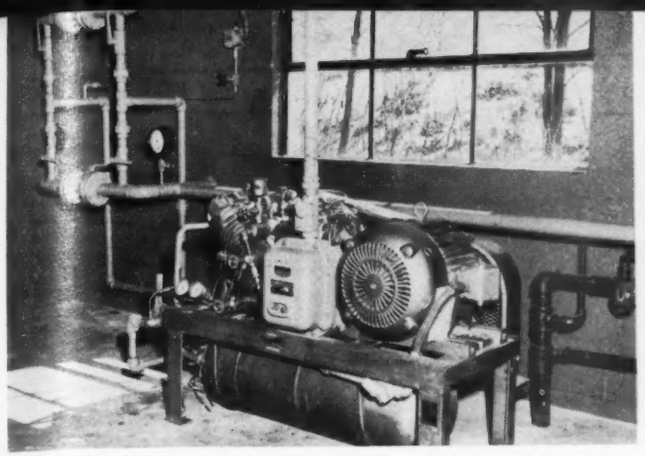
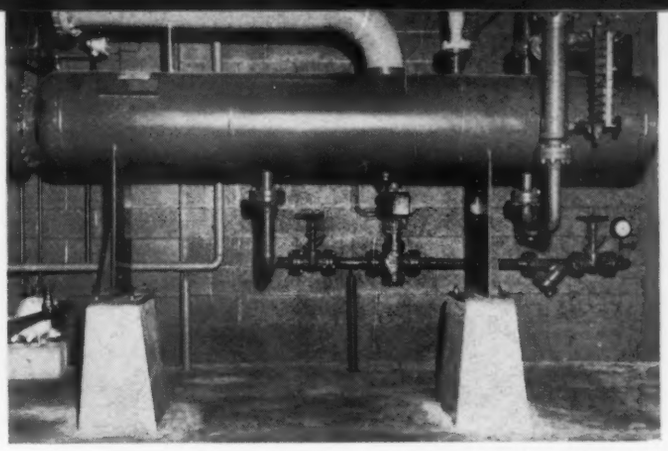

48 VOLT DC POWER SUPPLY
FIRE SWITCHES
PLANT START RELAY
BOILER CONTROL RELAY
VAPOR PUMP STARTER RELAY
STEAM SUPPLY PRESSURE SWITCH, PS-3
STORAGE VESSEL PRESSURE SWITCH, PS-4
AIR COMPRESSOR COOLANT CONTROL RELAY
AIR COMPRESSOR
AIR COMPRESSOR STARTER RELAY
PROOF SWITCHES
UNLOADER CONTROL RELAY
AIR SUPPLY PRESSURE SWITCH, PS-2
HEATING VALVE SWITCH ON COLORIMIXER
LOW FLOW RATE SWITCH ON TELEMETER TRANSMITTER
RELAY CONTROLLING OPERATION OF PNEUMATIC TIMER SOLENOIDS CONTROLLING BLOCK VALVES, STEAM FEED & LIQUID FEED
HYDRAULIC PUMP STARTER RELAYS
VAPOR FLOW AND AIR-PROPANE RATIO LIMITING SWITCH PS-1
RELAY CONTROLLING OPERATION OF PNEUMATIC TIMER SOLENOID CONTROLLING AIR FEED
AIR VALVE CONTROL LINE PRESSURE SWITCH, PS-5
RELAY TO TRANSFER COLORIMIXER SAMPLE TO PROPANE - AIR
SYMBOLS
RELAY OR SWITCH CONTACT
RELAY COIL

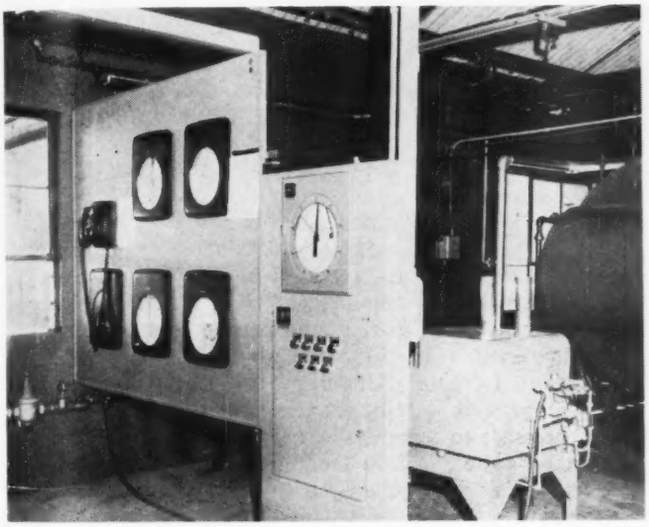
FIG. 3. **Simplified diagram of sequence control** relay panel shows sequence of operations in starting propane-air plant.

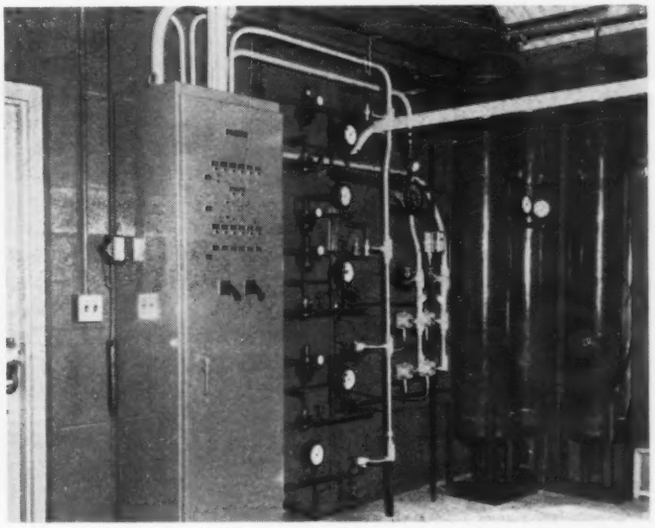


Unloading and pressurizing compressor with valve nest at left.



Vaporizer-superheater, showing liquid control valve and piping. Level control is at right.





Recording instruments, telemeter transmitter, and calorimixer panel and tank are shown in photo at left. **Supervisory field cabinet** is at left. At center is the solenoid valve rack referred to in Fig. 2, pressure switch rack, and capacity tanks used in obtaining a slow opening of various control valves. Sash weight (at left of cabinet) is suspended by a chain passing over a pulley and stretched across full length of the ceiling. Chain contains several 160 F fusible links that would part in event of fire, opening switch on side of cabinet and shutting plant down. Vaporizer building has similar arrangement.

of nineteen ¼-in. OD copper tubes with metal armor and a polyvinyl sheath. Hot water is circulated through two tubes to keep the bundle warm, thus preventing the possibility of condensate freezing in the air lines, or condensation of propane in the sensing lines.

Process Sequence Control

Most of the control valve operations are performed by diaphragm operated valves that require air pressure to open them. In order to provide a controlled rate of opening on start-up and so give opportunity for the local controller to smoothly assume control, and also to control the rate of closure on shutdown, a system typified by Fig. 2 is used.

As soon as air pressure has been made available by the starting of the compressor, the pressure control pilot, sensing a vaporizer pressure below its control point, puts out a 20 psi signal to open the steam valve. This signal pressure, however, is blocked by pneumatic relay No. 2.

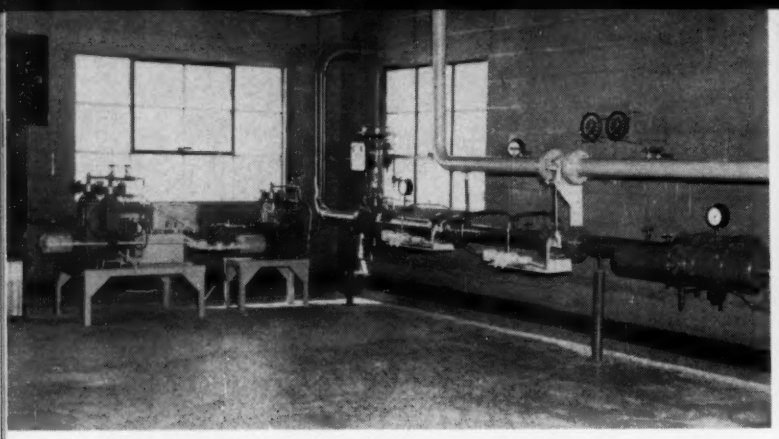
When the solenoid valve is energized, vent "C" is closed, and air passes from port "B" to port "A" charging the air capacity tank. The rate of pressure increase is determined by the setting of a needle valve. This slowly increasing pressure is applied to the diaphragm of relay No. 1, is reproduced at its outlet and applied to the diaphragm of relay No. 2. The diaphragm of the steam valve now receives this increasing pressure and slowly opens.

As steam flows into the vaporizer tubes, propane begins to vaporize, increasing the pressure in the vaporizer. When the control point of the pressure pilot is reached, its output to the inlet of relay No. 2 is reduced. As this pressure reduces to equality with the start-up signal, the pressure pilot takes over control. The start-up signal pressure continues to increase until it reaches 20 psi whereupon full stroking of the steam valve is possible.

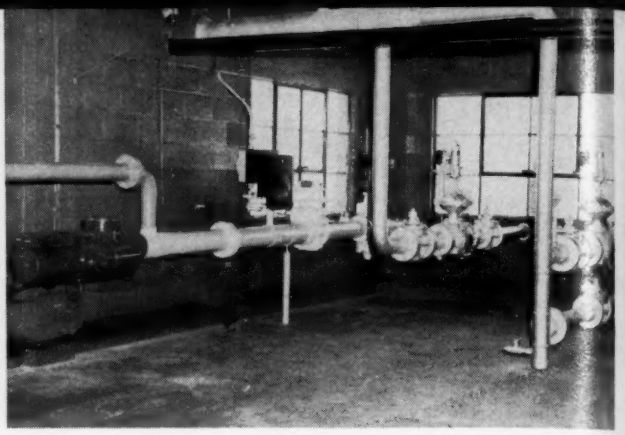
Start-up of the liquid valve and air block valve is essentially identical in principle. The operation of the flow control valve will be described as part of the start-up sequence.

The sequence control relay panel is shown in simplified schematic form in Fig. 3. When the operator presses the office unit start button, a coded signal is transmitted to the field unit and, subject to verification of the signal, the start relay pulls in and seals. As the fire switches are normally closed, the boiler control relay and the vapor pump starter relay are energized. The boiler starts and operates on its own pressure control. The vapor compressor pressurizes the storage tanks to the extent necessary.

When steam pressure and storage pressure are adequate, corresponding pressure switches PS-3 and PS-4 close, thereby continuing the circuit to the air compressor coolant control relay. Water drains are closed and water is introduced into the compressor jackets and intercooler by means of solenoid valves. When water appears at the discharge, a water flow switch closes, completing the circuit through other



Equipment in the air line, in photo at left, left to right, includes air pressure control valve, hydraulically operated air flow valve, hydraulically operated duplex butterflies, and piston operated blocking valve. GPE controllers are at left background, with vapor and air lines along right wall.



At other end (photo at right) are the differential flow controller, Daniel orifice fitting, and propane-air flow control valve. Rockwell natural gas regulators are at right.

compressor proof switches and energizing the motor starter.

At the same time, the electro-pneumatic unloader is energized but loading is delayed sufficiently by means of a bleed block in the pneumatic lines for the compressor to attain full speed. The closing of the air pressure switch continues the circuit to the low-flow switch. As no metering differential yet exists, the low-flow switch incorporated in the flow transmitter is closed. (The heating value switch is open at this time.)

The hydraulic pumps on the differential ratio controller are started, and at the same time, a relay closes energizing three-ported solenoid valves. These solenoids are identified as SV-2A, SV-2B, and SV-2C in Fig. 1.

Solenoid SV-2A provides air pressure to open the piston operated plug valve POV-1, which is the remote liquid shut-off valve at the storage tanks. It also opens block valve POV-2 in the air line and closes vent valve AV-2. Solenoid SV-2B provides a pneumatic start-up signal pressure to open the steam control valve in the manner previously described. Solenoid SV-2C similarly energizes the liquid control valve.

Output pressure of solenoid SV-2B is also transmitted to the flow control valve pneumatic relay RI-G through a limiting regulator PR-2A set at about 4 psig. The flow control valve FCV-2 opens concurrently with the steam valve until it reaches a slightly open position, as determined by the 4 psi limitation. It remains in this position until mixing air is introduced.

As steam and liquid propane enter the vaporizer, the flow of propane vapor is sensed by the vapor flow switch PS-1, which closes, continuing the sequence circuit shown in Fig. 2, to operate solenoid valve SV-2D. When this valve is energized, a slowly increasing start-up signal pressure is applied to the air pressure regulator FCV-6 upstream of the mixing control.

As air is introduced into the propane stream, the differential ratio controller assumes control. The start-up signal to the air pressure is also transmitted to the flow control valve, and as it increases beyond 4 psi, it overrides the output of the limiting regulator PR-2A and in a few minutes, full stroking of the flow control valve becomes possible.

Meanwhile, the flow controller intercedes and holds the flow rate at its set point. This setting has to be low enough to prevent the low-flow switch from breaking circuit. As the air pressure regulator opens, the signal pressure to it is also applied to a pressure switch PS-2A, which closes to start the calorimixer and transfer its connection to the propane-air sample line.

As the calorimixer senses the sample of gas being produced, it adjusts the heating value to the control point. When an acceptable heating value is indicated, the heating value switch closes, shunting the lowflow switch. The operator is notified through the supervisory system of this fact, whereupon he can increase production rate to any level within the plant's capacity.

When the plant is shut down, either intentionally or because of malfunction, all relays in the sequence panel deenergize, shutting down all components and transferring the solenoid valves. The remote liquid valve and the air block valve close within 30 seconds. The air and liquid control valves also close rapidly. The steam valve closes slowly, the rate of closure being determined by the setting of the needle valve in the exhaust connection of solenoid valve SV-2B. As long as control air is supplied to the steam valve, the flow control valve remains in a slightly open position. Although the boiler is now shut down, the residual heat is sufficient to boil out the vaporizer.

Telephone transmission line failure will not shut down the plant. Provided local protection devices remain satisfied, the plant will continue to operate at the existing flow rate setting. Loss of telemetric signals will immediately indicate to the system operator the occurrence of a line fault.

Electric power failure will shut the plant down and it will not restart upon power restoration until the remote operator calls for a new start-up.

Shut-down due to fire requires manual resetting of the fire indicators. A component failure will shut down that part of the process that is subsequent to it in the starting sequence. The restart will proceed from this point upon correction of the fault.

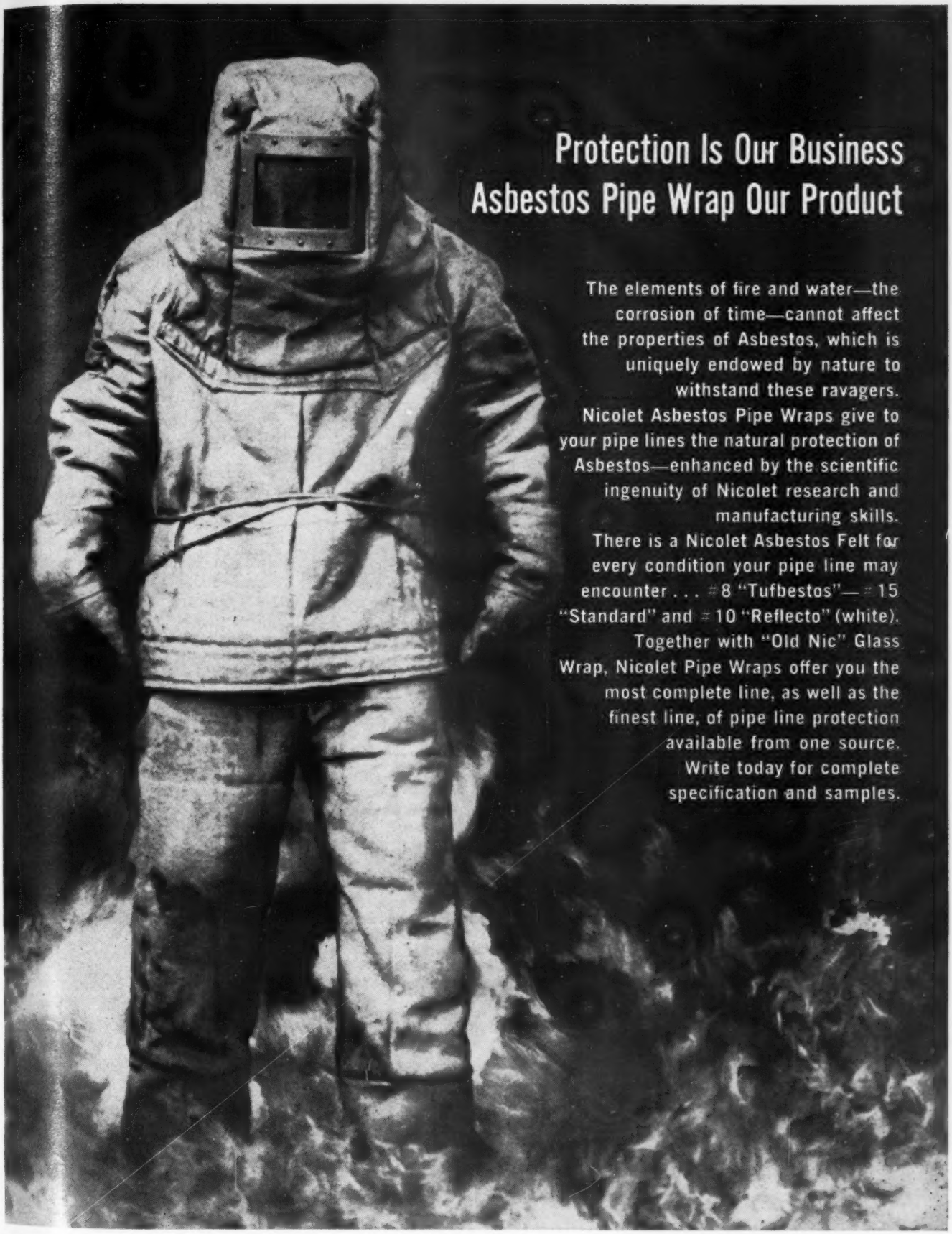
A high degree of security is built into the supervisory system to guard against unwanted control action that might otherwise result from spurious signals on the transmission line or malfunction of the supervisory equipment itself.

Economic Factors

A peak shaving plant may defeat its own purpose if the investment is large. By utilizing its own engineering and construction personnel, and by careful design, Orange and Rockland Utilities, Inc. held the investment in this new plant to about $33 per Mcf per day of capacity, including everything from land clearing to painting, and without compromise on quality of components or workmanship, or consideration of safety. The extra cost of the remote control feature was moderate and readily justified.

Experience

The plant was first tested on remote control in January 1961. The "bugs" were minor and easily eliminated. Three unattended starts were made early in February for actual peak shaving with very satisfactory results. Starting time with warm boiler water is about six minutes. Full capacity is available in about 12 minutes. If the boiler and air-compressor are independently started by remote control ahead of time, the starting time is reduced to about two minutes. * * *



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Distribution Developments

NEWS ABOUT CURRENT AND PLANNED CONSTRUCTION

Public Service Company of Colorado, Denver, Colo., recently received two new franchises in Niwot and Hygiene. Installation of a new distribution system has already started in Niwot. Three miles of 4-in. intermediate pressure gas main and two miles of 2-in. gas main will serve the town of Niwot and a new residential subdivision southeast of Niwot. This line when completed, will serve 55 customers and has a potential of about 500 customers. In Hygiene area, 5.5 miles of 3-in. intermediate pressure gas main is being installed from west of Longmont to McCall's Lake. Approximately 75 customers are scheduled to be served.

Company also plans to initiate gas service to Erie, Colo., in the near future. Its subsidiary, Colorado-Wyoming Gas Co., has FPC approval to construct a 4 mile 3-in. lateral supply line to Erie. Estimated annual and peak day requirements for the new distribution system are 43,840 Mcf with peak day sales ranging from 342, the first year (1962), to 524, the third year (1964).

Fort Ord, Monterey County, California, plans to install a $211,000 low pressure addition to its gas distribution system to serve a new 500-unit increment to Capehart housing on the base. To be installed are approximately 5100 ft of 10-in. mains at a cost of $35,000; 5200 ft of 8-in. at cost of $28,000; 8670 ft of 6-in., $41,000; 1415 ft of 4-in., $5600; 8200 ft of 3-in., $24,000; 35,300 ft of 1-in. $53,000, and 25,000 ft of ¾-in. at cost of $25,000. No contractor has been named at press time; work is to be completed in 1962.

Wisconsin Public Service Corp., Milwaukee, plans to spend approximately $2,571,000 for new gas distribution construction by the end of April 1962. Introduction of natural gas to Brillion, Reedsville, and Valders will cost $571,000, and additions to existing gas systems more than $2,000,000. Company recently received franchises to supply natural gas in Algoma, Kewaunee, and Sturgeon Bay.

Boston Gas Co., Boston, has petitioned the Massachusetts State Department of Utilities for authority to provide gas service for the towns of Carlisle, Roxborough, Harvard, and Shirley. The four towns do not presently have gas service and are not franchised to any gas company.

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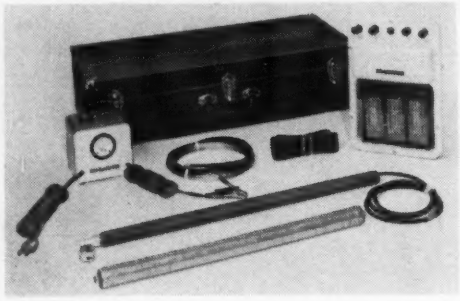

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The Suburban Fuel Gas, Inc., Cygnet, Ohio, (a new company) plans to build distribution systems in Hicksville and Sherwood in Defiance County, Ohio, and has asked the FPC to direct Panhandle Eastern Pipe Line Company to connect and serve. Suburban estimates total cost of the lateral and two distribution systems at $750,000 of which $88,090 goes for work in and around Sherwood; and $661,910 for work in and around Hicksville. Planned is a 6-in. line that will run from intersection of Panhandle's line with Ohio State Route 18 approximately 6.2 miles to Sherwood, then another 10.1 miles into Hicksville. Cost breakdown of construction indicates at Sherwood approximately $9540.68 will be spent for pipe; $3742 for fittings; $8190 for meters and regulators; $39,140 for labor; $9000 for contingencies and overhead; $5777 for legal and engineering; and $12,700 for 3-year capitalized interest. At Hicksville $165,143 will be spent for pipe; $14,722 for fittings; $40,197 for meters and regulators; $237,680 for labor; $66,000 for contingencies and overhead; $101,800 for 3-year capitalized interest and $36,367 for legal and engineering fees.

In Mobile, Alabama, a 55-year-old cast iron gas main was maintained in service when it was uncovered as the result of a major road construction project and found to be excellent condition. The 16-in. line which has been in continuous use since it was installed in 1906 was lowered and is expected to give Mobile Gas Service Co. good performance for another 50 years.

City of Kuttawa, Kentucky, a new municipal operation, plans three new distribution systems in the communities of Kuttawa, Lake City, and Grand Rivers, Kentucky. In a filing early in July, the City asked the FPC to direct Texas Gas Transmission Corp. to connect and serve. Planned is a 6- and 4-in. supply lateral (1300 ft of 6-in. and 51,000 ft of 4-in.) from Texas' line near the intersection of Kentucky Highway 93 and Sunnyside Road, to Kuttawa and Grand River. Approximately $246,866, tabbed as direct costs, will be spent — $124,592 for the supply lateral and $122,274 for the distribution systems. Approximately $2990 of the total cost goes for 1300 ft of 6-in. supply lateral; $54,402 for 29,200 ft of 4-in.; $67,200 for 64,000 ft of 2-in.; $71,250 for 47,500 ft of 2-in.; $18,700 for 22,000 ft of 1-in. $3304 for 472 tee services; $2900 for high pressure metering; $1200 for regulating station; $16,520 for 472 meters at service connection; and $2400 for road crossing encasement; $3000 for 6 regulating stations, $3000 for valves.

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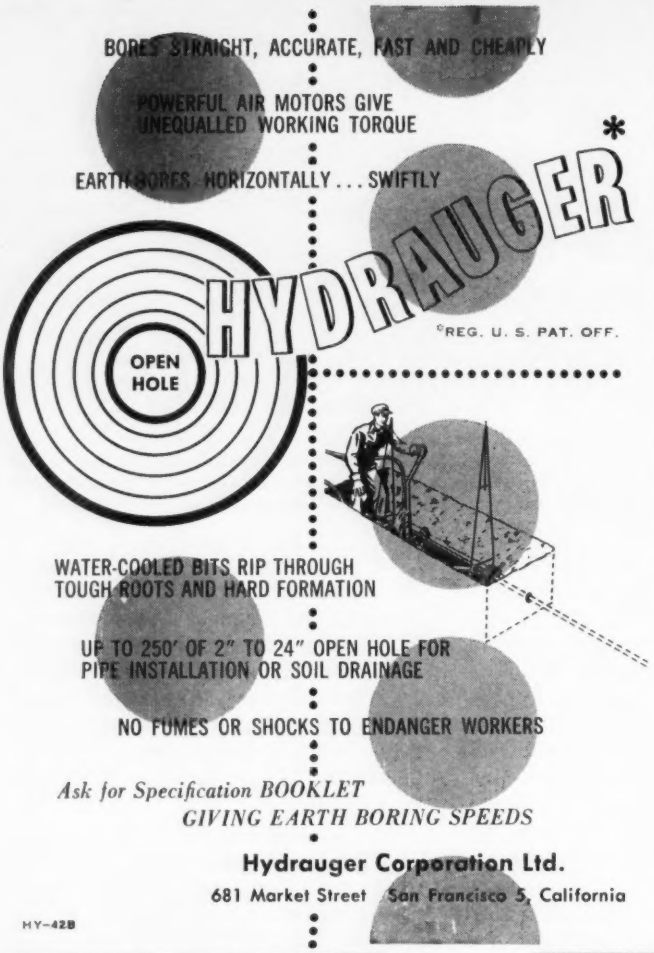
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Distribution Developments

Iowa-Illinois Gas and Electric Company, Davenport, Iowa, recently received a 25-year natural gas franchise from the city of Fremont, located near Ottumwa, Iowa. Construction will include extension of 3960 ft of gas main from Iowa-Illinois' present line to Fremont and 20,000 ft of mains within the town for distribution system plus service runs. Estimated cost is $90,000.

Also planned is a new distribution system in Durant, Cedar County, Iowa, as soon as company secures FPC approval of CP62-4. Approximately $117,509 is estimated as cost of construction of a 7 mile 4-in. lateral from existing facilities in Muscatine County, extending northeasterly to the city limits of Durant, and another $180,939 for distribution system. Details of the construction of the distribution system in Durant include installation of 3200 ft of 4-in. main ($12,156), 4000 ft of 3-in. ($11,320), 11,800 ft of 2-in. ($23,240) and 15,500 ft of 1¼-in. ($25,682). All mains are steel, and mill wrapped. Approximately $14,671 is tabbed for a town border station and a regulator station; $2844 for telemeter equipment; $62,928 for installation of gas services; $23,712 for installation of gas meters, and another $4386 for supervision and engineering, general administrative, and street repair.

The Gas Service Company, Kansas City, Missouri, plans to install a new distribution system around Lake Tapawingo, an unincorporated city. Contract was arranged with company and the lake board of directors. System has a potential of approximately 300 meters. The lake is located north of U. S. Highway 40 about 5 miles west of Blue Springs, Missouri. Construction involves approximate installation of 2290 ft of 6-in., 15,300 ft of 4-in., and 6300 ft of 2-in. lines. Company crews of the Lee's Summit division will do the work.

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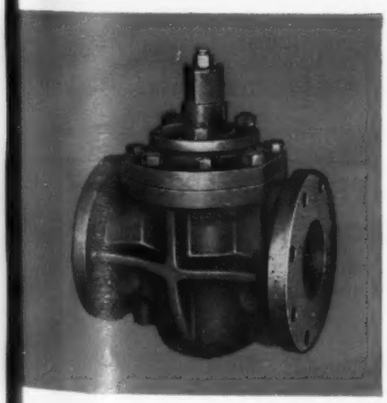

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For Small Industrial and Commercial Loads

- Compact and light weight – only 18 lbs.–savings in shipping, handling and setting costs.
- Available with Temperature Compensation.
- Die-cast, one-piece aluminum alloy body – high resistance to impact damage–steel connection threads eliminate galling.
- Bellows-type Duramic diaphragms for all fuel gas services.
- Rated capacity of 425 cfh at ½-inch w.c. differential with 0.64 sp. gr. gas–10 psi maximum working pressure–1¼-in. MC connections.
- Longest service life at lowest cost per meter per year of service.

See Bulletin 317 for details.

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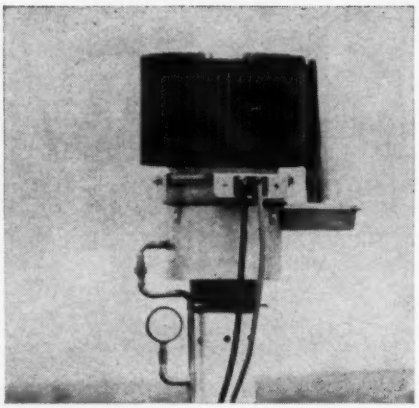


Thermoelectric generator . . . for cathodic protection . . . is now available from Texas Instruments, Inc. The 8-watt unit contains no moving parts, will operate on natural gas, propane, or butane, and is primarily designed for remote unattended instrumentation. Can be used for remote operation of valves, and for cathodic protection of buried or submerged pipelines. Initial installation costs are said to be lower since the units can be used where commercial power has never been available. Units will operate with complete efficiency during continual exposure to elements. No housing or special enclosure is required as generator's burner is completely free from wind blowout. Unit weighs 65 lb is 12-in. wide and 17-in. high. **1**

Packaged gas turbine power units are now being offered by Mission Manufacturing Co. in the 35 to 850 hp range utilizing turbines manufactured by AiResearch Manufacturing Co. Three general types of packages are available. One type supplies energy in the form of compressed air. Another, in the form of shaft power. And the third type provides shaft horsepower and compressed air power simultaneously or either form of power independently and interchangeably. Units can furnish heat at 10,000 to 100,000 Btu per min in free flowing air up to 950 F, or compressed air from 90 to 500 F. They can also provide large volumes of compressed air at 30 to 350 psig with only 10% of conventional equipment weight. **2**

Protection for small diameter pipe. Complete description of Hill Hubbell X-Tru-Coat, the high-density polyethylene pipeline coating that is bonded to steel pipe, is given in new 4-page bulletin. Included are physical and electrical properties, a corrosion resistance table, and sketches of typical applications of the new coating. Hill Hubbell was recently licensed to produce X-Tru-Coat under patented Dekoron process. Initially, coating will be available on pipe sizes ranging from ¾- to 4½-in. OD. **3**

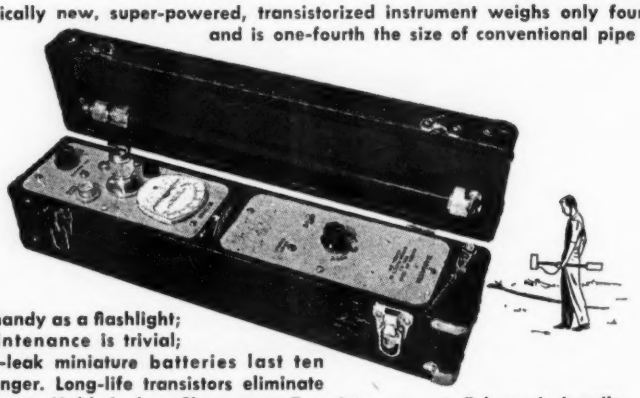
Pipe Dimension Chart . . . showing outside diameter and wall thickness for all sizes of pipe from ½ through 42-in. is available free from Midwest Piping Division, Crane Co. Chart includes information from ASA Standard B36.10 showing IPS and Schedule numbers and their relationship, and includes latest wall thicknesses added in the 1959 revision. **4**

Flexible flanged coupling adapters is subject of new 12-page, 2-color brochure just issued by Smith-Blair, Inc. Detailed information is given on how these fittings can be incorporated into design of gas systems or used for "cutting-in" flanged fitting installations in existing lines. Charts show complete range of plain- and machined-end pipe sizes and flanged fittings. **5**

Free slide rule simplifies task of sizing control valves for known conditions of flow, pressure, etc.; solves for C_v and corrects for steam quality, gas specific gravity and temperature. Standard slide-rule scales A, B, C, and D are also incorporated. Step-by-step instructions included. **6**

The MINIATURIZED-PRECISION WILKINSON Line Locator Model W-3

This radically new, super-powered, transistorized instrument weighs only four pounds and is one-fourth the size of conventional pipe locators.



It is as handy as a flashlight; the maintenance is trivial; the non-leak miniature batteries last ten times longer. Long-life transistors eliminate replacement. Molded glass fibre cases. Transistor ear set. Telescopic handle. Etched circuitry. Contained in carrying case.

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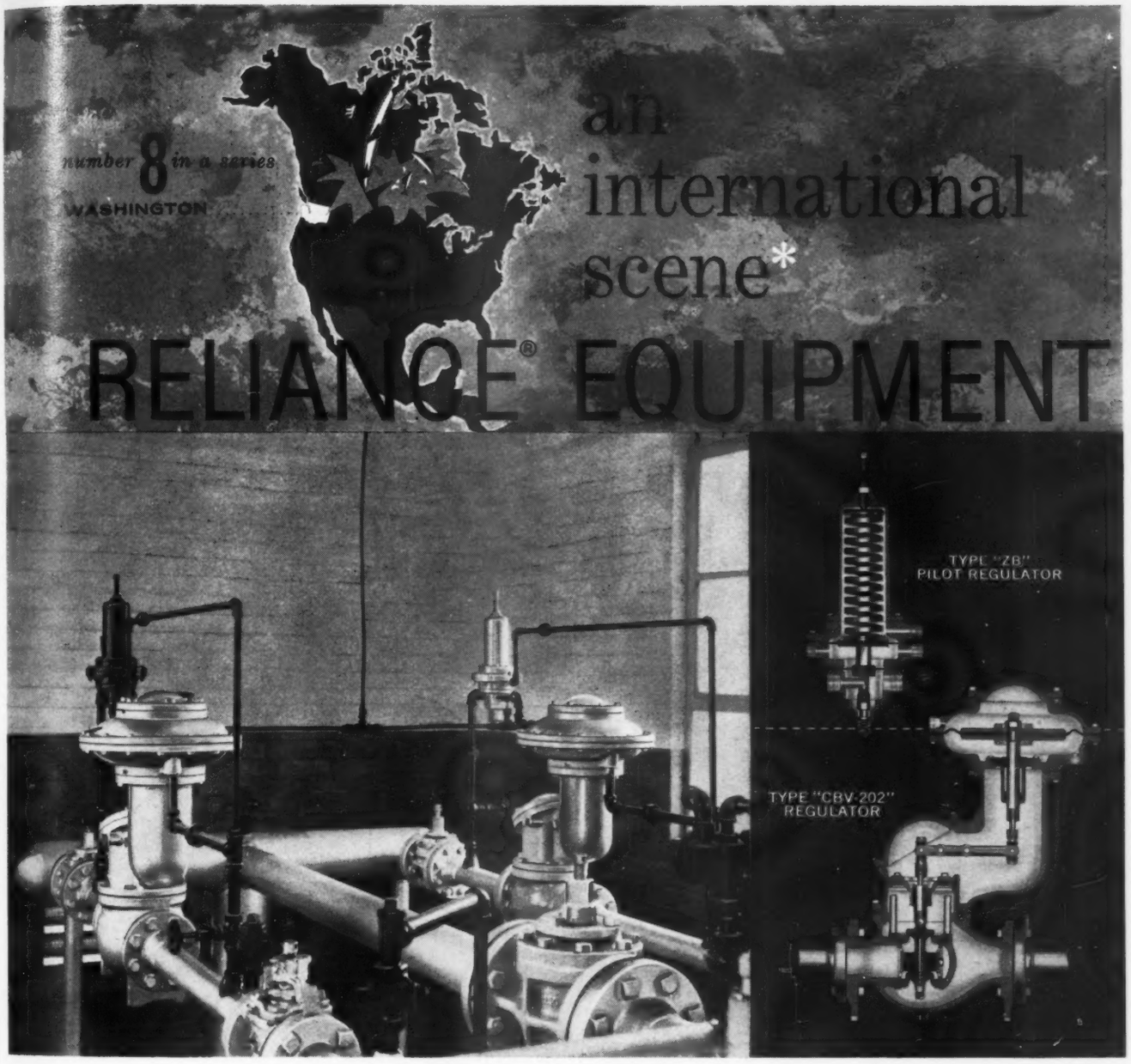
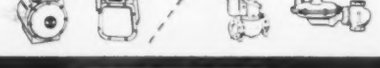


One of many compact, safe and reliable gas control installations

This is a typical application for high pressure regulation. Illustrated are two Type "CBV-202" High Pressure, Offset Connected, Pilot Loaded Reducing Regulators. Outlet pressure ranges 1 to 300 lbs. Available in 2 to 12" sizes. These fully inclosed balanced valve regulators are ideal for vaults. ■ Also illustrated in this installation are two Type "ZB" High Pressure Pilot Regulators. Inlet pressures up to 1000 lbs. may be safely handled with outlet pressure range of 2 to 225 lbs. ■ *Write for bulletins containing complete specifications.*

All over Washington you will see installations equipped with RELIANCE REGULATORS and AMERICAN METERS for dependable control and precise measurement of gas.

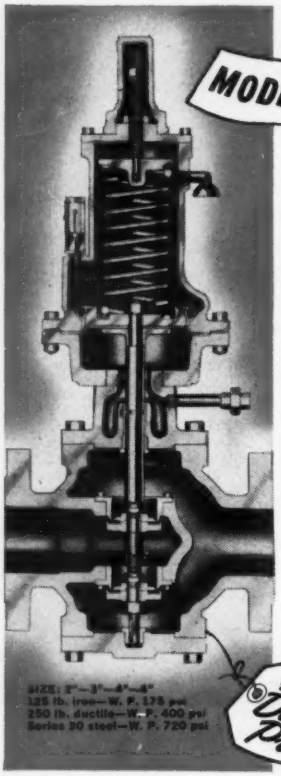


General Sales Offices in principal cities in the United States and Canada

AMERICAN AMERICAN METER CO MEASUREMENT ENGINEERS **RELIANCE**

Pressure Drop through lubricated plug valves. New 12-page bulletin available from Walworth Company gives flow characteristics of Walworth lubricated plug valves in a form where system designers may now, through the bulletin, select the most efficient and economical valve for their particular piping needs. Bulletin lists 85 lubricated plug valve figure numbers from which the engineer may select data and calculate pressure drop with either the K-values or Equivalent Feet method. Computations covered in the bulletin fulfill most piping requirements. 7

Bristol's new Metagraphic pneumatic receiver . . . with 4-in. strip-chart width . . . is subject of 6-page illustrated bulletin. Brightly-colored distinctively-shaped pointers on the instrument are visible from a distance and enable the dispatcher, with a sweep of his eye, to determine whether conditions are satisfactory and any variations from the control point. Instrument features new removable chart-drive mechanism, capillary inking system for trouble-free recording, and elimination of the "Seal" position from the control function switch. 8



CHAPLIN-FULTON

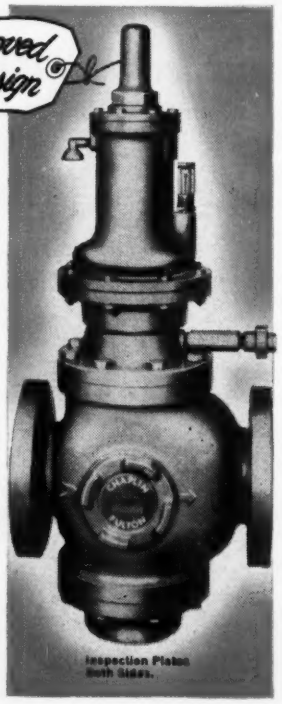
MODELS 441 461-57S

Gas Regulator

Model 57-S, for pounds-to-pounds service, operates on a new principle which maintains accurate control throughout full valve travel. The *patented* diaphragm action compensates for the "fall-off" in conventional spring regulators, which greatly limits their capacity to allowable droop. You can reduce costs greatly by installing a 57-S, one or even two sizes smaller than previously, to deliver the same volume. Usable Capacity = 100% of potential capacity. Controlled pressures—3 to 75 psi—with *one* assembly.

Advanced Diaphragm Principle

Improved Body Design



Also, new improved body design—either 441 or 461—with enlarged flow areas and standard face-to-face dimensions for easy replacement. Available in iron, nodular ductile or electric steel. And an extra value—inspection plates on *both* sides, O-ring sealed —for quick removal and ready inspection. A valve travel indicator to check position and estimate flow, pressure and water tight.

New principle—new design—new versatility—greater economy.

ACCURATE CP MFG CO DEPENDABLE

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61-571

Ability to trench flush against a building, loading dock, or retaining wall, is feature of Davis T-66's new attachment. Special boom mounting bracket sets digging chain assembly to extreme left of shaft. Auger is removed permitting vertical dirt shield to deflect spoilage to right of trencher. Attachment can be installed by one man in minutes with no loss in digging range. Trenches its full 3 to 4-in width down to 66-inches, or 12-in. wide to 30-in. deep as well as varying widths and depths between. 9

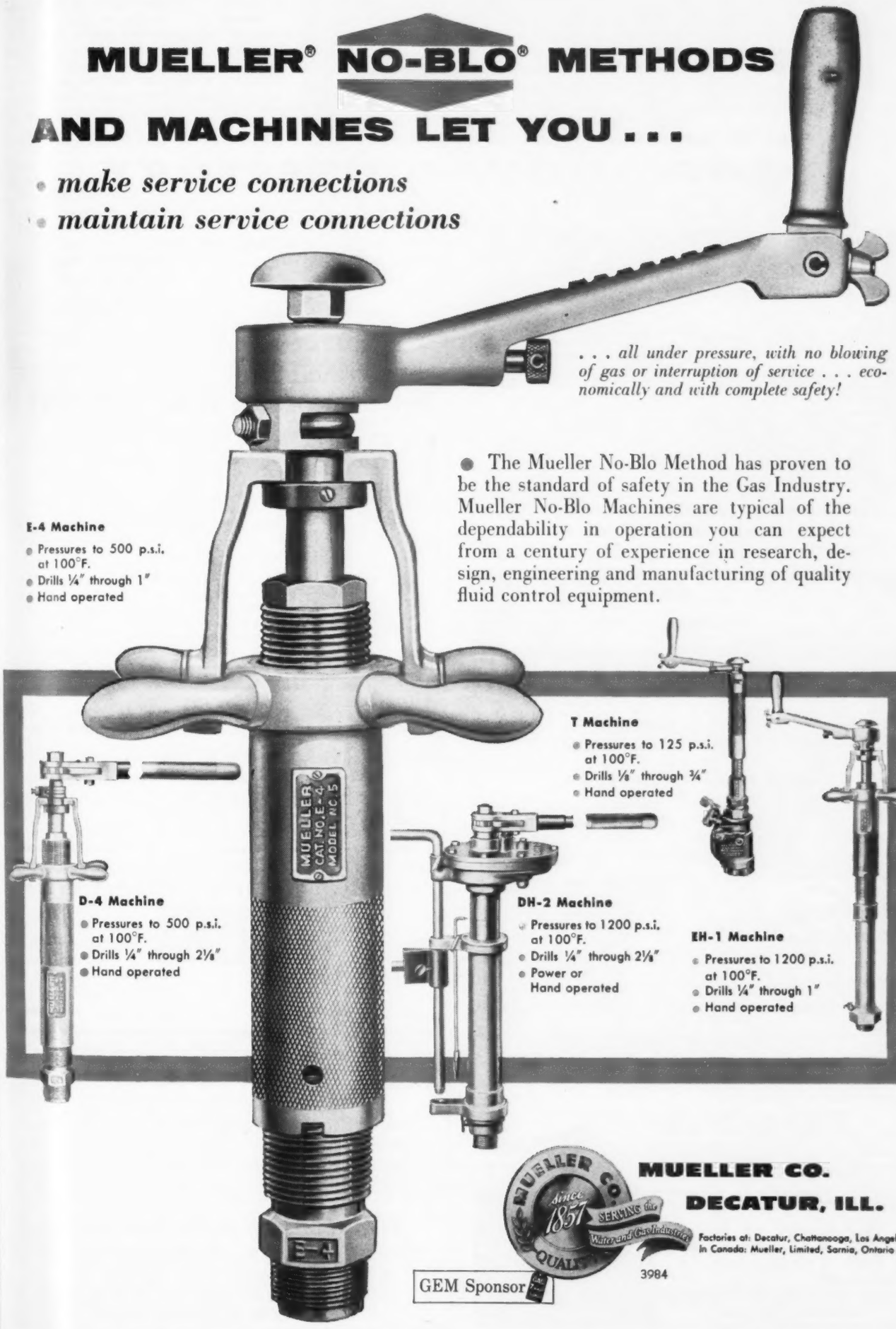
Simplified connecting and sealing methods are described in new 8-page booklet, "How, When and Why to use a V-Band Coupling," prepared by Marman Div. of Aeroquip Corp. Booklet explains how the simplified fastening of the V-band coupling can improve functional design, decrease assembly time, and cut costs. Also illustrates a few of the many available coupling and flange configurations, explains the sealing principle, and shows typical V-band applications. 10

Eye Protection Chart. American Welding Society has published a chart giving correct shades of glass to be used for proper eye protection in all welding and cutting operations. On left of chart are various soldering, brazing, cutting, and welding operations. On the right are listed the correct shade numbers to use for each process. Operations are arranged in order of increasing shade numbers. Soldering, therefore, with a relatively low light intensity is listed first. Shade numbers increase as light intensity increases, until highest shade number is reached when carbon-arc welding is used. Charts intended for display in all welding shops. Available at 50 cents each. 11

ABS plastic pipe . . . called ideal for use in transporting natural gas, irrigation water, and salt water . . . is subject of 4-page 2-color bulletin from Johns-Manville. The new semi-rigid thermoplastic pipe features exceptional corrosion resistance, high impact strength and surge resistance low friction loss, and is pressure rated up to 140 F. Is available in ½- through 3-in. pipe diameters. Can be joined by solvent welding. 12

MUELLER® NO-BLO® METHODS AND MACHINES LET YOU . . .

- *make service connections*
- *maintain service connections*



. . . all under pressure, with no blowing of gas or interruption of service . . . economically and with complete safety!

● The Mueller No-Blo Method has proven to be the standard of safety in the Gas Industry. Mueller No-Blo Machines are typical of the dependability in operation you can expect from a century of experience in research, design, engineering and manufacturing of quality fluid control equipment.

E-4 Machine
- Pressures to 500 p.s.i. at 100°F.
- Drills ¼" through 1"
- Hand operated

T Machine
- Pressures to 125 p.s.i. at 100°F.
- Drills ⅛" through ¾"
- Hand operated

D-4 Machine
- Pressures to 500 p.s.i. at 100°F.
- Drills ¼" through 2⅛"
- Hand operated

DH-2 Machine
- Pressures to 1200 p.s.i. at 100°F.
- Drills ¼" through 2⅛"
- Power or Hand operated

EH-1 Machine
- Pressures to 1200 p.s.i. at 100°F.
- Drills ¼" through 1"
- Hand operated

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GEM Sponsor

Low-pressure alarm . . . called the Pak-Alarm . . . is now available from Scott Aviation Corp. The alarm is a completely self-contained, self-energized, self-powered warning unit, which, utilizing the gas itself as motive power, sounds a loud audible warning whenever the pressure falls below a predetermined point. It requires no electrical power, no switches, no gages. The audible warning automatically sounds at a predetermined point, and continues to sound until system pressure increases to a point above the present warning pressure. 13

Domestic temperature-compensated Rockwell gas metering is described in a revised brochure now available from Gas Products Div. of Rockwell Manufacturing Co. Proving techniques and accuracy checks are described as well as how to adjust temperature-compensated Rockwell meters. 14

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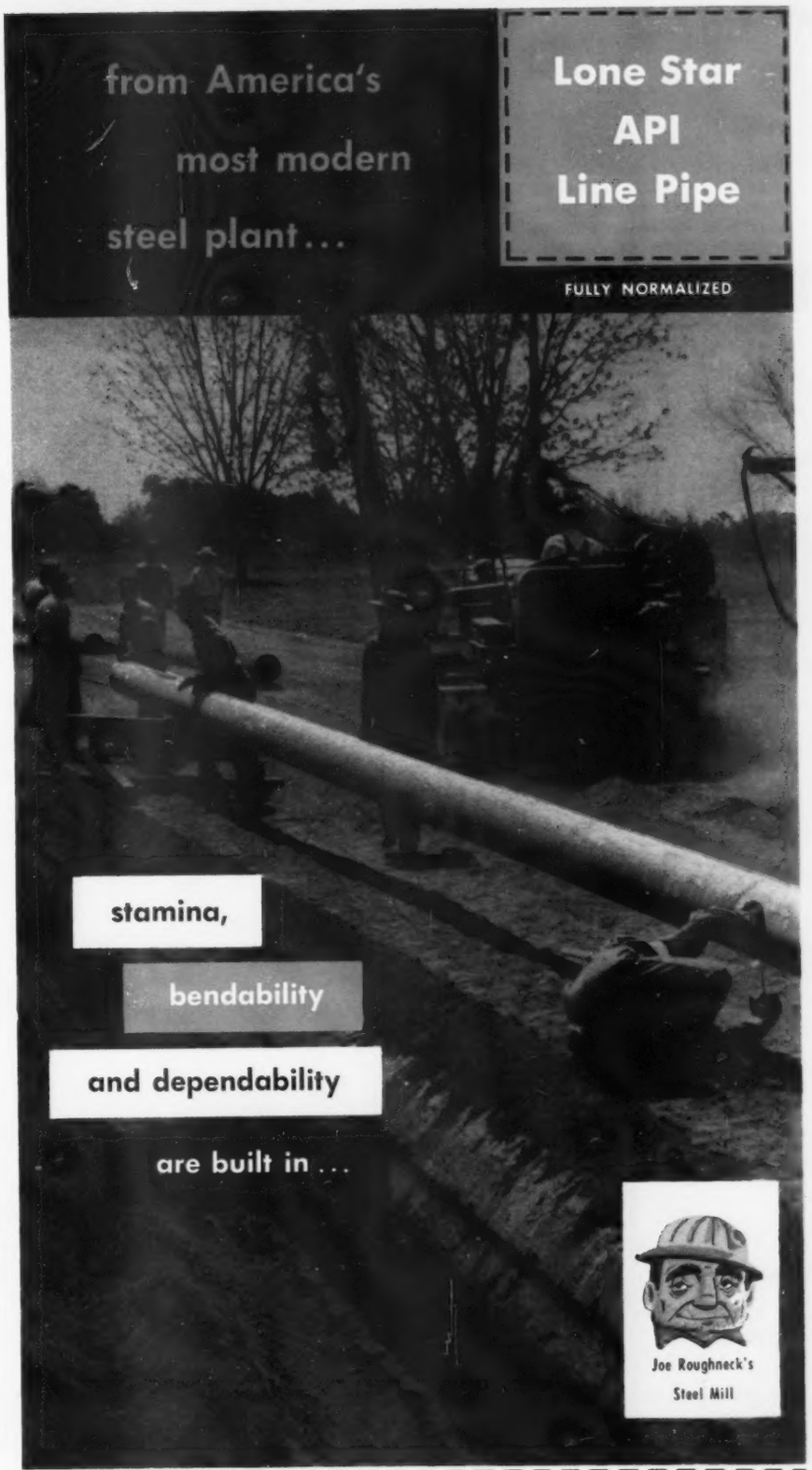

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Public Utility Applications. New 1404 printer for the IBM 1401 data processing system, enables public utility firms to obtain fast, accurate printing of either individual cards or continuous paper forms as direct output from a computer. This can provide significant time savings in many utility operations, including those in which printed IBM card documents are widely used. In particular the printing of a wide variety of cards can be greatly expedited by the 1404 in such areas as customer billing, payroll, inventory, and stockholders accounting. When the 1404 is used with an IBM 1401 magnetic tape system, printing and punching of cards can be performed in the same run. For example, card bills can be punched and printed at the same time in the preparation of public utility customer bills. **15**

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Engineered to prevent most common valve problems. Oversize stud provides friction-free contact with index drive flag. Micro-finish lapped surface assures perfect seal. Extra heavy valve shell covers top and sides of carbon-graphite ring for full protection.
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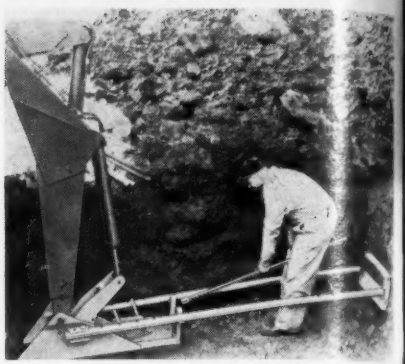
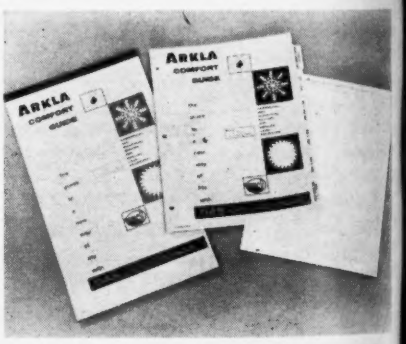


Heavy duty pipe pusher . . . call the Pow-r Mole . . . can push rod in any condition where pushing is possible and pull ½- to 3½-in. diameter copper, steel, plastic pipe, or tubing underground with "exceptional accuracy." Unit attaches to standard tractor-mounted hydraulic backhoes, comes complete with full set of cribbing, 50-ft push rod and pusher cap. Has a 5-in. stroke and operates at a force of up to 35 tons. **16**

Pressure Measurements. New 4-page bulletin describes new instrument that may be used with a high degree of accuracy as low pressure deadweight gage or a high range differential pressure manometer. Unit has a working pressure rating of 2000 psi for the standard model, with higher pressure models being available upon request. Manufacturer claims instrument has exceptionally high accuracy. Standard and dual scales may be read to 0.1 in. of W.C. or 0.01 psi, with there being a full scale of 1000 in. of water or 36 psi. Other scales available upon request. Instrument is lightweight and portable. Total weight, exclusive of carrying cases, is 26 lb. **17**



An aid to calculating heating and cooling load has been developed by Arkla Air Conditioning Corp. Data such as glass, shading, and latitude factors are combined in easy-to-read tabular form to help simplify load calculating. The new 94-page Comfort Guide manual is part of a 3-element load estimating package that includes a companion pad of 50 heating and cooling load estimation forms and the Arkla Psychrometric Chart. The Comfort Guide manual, combines summer load factors in a single table for each principal kind of window glass. Also, there is a table for each of 5 geographic zones — 30 through 50 degrees of latitude — with data on single-thickness glass on one side of the sheet and double on the other. In addition to various types of window glass, similar tables cover glass block, walls, roofs, ceilings, floors, partitions, people, appliances, and ventilation air. Also included are appendix tables on simplified air volume calculations, heat removal, building materials lag, and shade factors. **18**